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PREFACE

Sandalwood is an example of nature's bounty and the oil concealed in the inner core of its heart-wood is another hidden treasure. India is one of the rare countries gifted with this fortune. The Indians have enjoyed the love of nature and have taken the pearls in the form of sandalwood oil as gift.

Amongst the various essential oils produced in India, oil of sandalwood has the highest contribution to the foreign exchange earnings. A brochure on the marketing of sandalwood and its oil in India was brought out in 1961. The reception given to this publication was very much gratifying. It has long been out of print and also in the meanwhile a lot of changes in the marketing pattern of sandalwood oil have taken place. The production as well as export of oil of sandalwood has declined significantly. This prompted the study into the various aspects/problems concerned with sandalwood oil and its trade.

In preparing this report, the aim has been to give a complete picture of sandalwood oil industry and trade, production-techniques followed in the country, import and export, utilisation, new developments and related problems. The primary data and information have been collected in detail by a systematic survey all over the country and the secondary data have been compiled from various publications and other sources.

The trade in sandalwood oil is facing a downward trend at this stage. The production which was about

200 tonnes in the past, has dwindled to nearly 70 tonnes, out of which India is in a position to utilise only 30 to 35 tonnes and the rest of it is being exported to other countries as a raw material for finished products like perfumes etc. These perfumes fetch a handsome price in comparison to the sandalwood oil. India is very much rich in flora and fauna spread over from Kashmir to Kanyakumari, available throughout the year which still remains unexploited. A technique of blending and developing certain perfumes under an organised institution can prove a mint of foreign exchange. This will further facilitate the opening of new industries to come up and provide employment opportunities. A well-planned organisation associating the traders, industry and scientific institutions is essential and the same may be considered on the pattern of Tea, Coffee and Rubber Boards. Such a set-up may also provide a base to look into the various problems of production, planning and processing to achieve overall development of these industries. Perhaps it will be in fitness of things to constitute an Essential Oils Board at the National Level.

In preparation of this report, a number of people, organisations and institutions have extended their co-operation to whom our thanks are due. We are especially thankful to S/Shri V. Jayappa, Director, Karnataka Soaps & Detergents Ltd. and R. Venkatesan, Chief Conservator of Forest, Bangalore who were kind enough to furnish the valuable information. We are also thankful to Dr. Nagarajan and his staff, Publication & Information Directorate Library, New Delhi,

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This report was prepared by Shri R. J. Verma, Dy. Agricultural Marketing Adviser with the Assistance of Shri V. K. Mittal, Asstt. Marketing Officer under the guidance and supervision of Dr. G.R. Bhatia, Joint Agricultural Marketing Adviser.

The Government of India should not be regarded as assuming responsibility for any of the statements/ comments appearing in this report.

ATUL SINHA.

Agricultural Marketing Adviser to
the Govt. of India

Dated : July, 1984
Faridabad.

1. EVOLUTION OF SANDALWOOD OIL INDUSTRY

1.1 Introduction

In the history of civilisation, man's first basic instincts were for self-preservation and survival. Once he had satisfied these desires, he began to develop his aesthetic tastes and appreciate the beauty of the natural world around him. This lent credence to his appreciation of the colour and odour of flowers. In olden times, man undoubtedly had a keener sense of smell, since like animals; he used this sense to warn of possible/potential dangers to his existence. As he became more civilised and communities of persons came into being, this keenness of his olfactory powers diminished. At the same time, however, he desired to recall odours that were no longer available to him owing to the fact that flowers did not bloom all the year long and from this desire, the art of perfumery was developed. The perfumer attempted to capture the elusive odours of the flowers and other products of nature, so that they could be enjoyed at all times and away from the natural object itself. In this search, he got sandalwood oil.

1.2 History of evolution of sandalwood oil trade

1.2.1 World :

The sandalwood oil trade is being carried out from ancient times. The sandalwood and its oil used to be exported to different countries from India through various means of transportation. In medieval days, it used to be exported to Egypt, Greece and Rome. In those days, the sandalwood oil was used for perfumery purposes only and the civilisation was at the awakening stage. Only very affluent people like kings, landlords etc. were in a position to afford its use. Hence the demand for the oil of sandalwood was limited. Therefore, the trade was restricted only to a few places. India continued to export sandalwood and its oil till 1914 without any hinderance in its trade. Most of the sandalwood was exported to Germany where oil used to be distilled by modern steam distillation techniques and supplied to different parts of the world. With the outbreak of World War-I, exports to Germany completely stopped due to lack of shipping space for more bulky wood. Export of sandalwood to other countries was also discontinued.

The sandalwood oil was fetching handsome prices in those days. Therefore, Australia also extracted sandalwood oil from different species of the tree and referring it to be sandalwood

oil, entered into the world market. But the same was different in quality characteristics and other chemical constituents. They tried to rectify the oil and market it as sandalwood oil, but it could not compete the Indian produce.

Some other competitors also came up. To face this stiff competition, the Indian traders agreed to sell their oil jointly to foreign countries. In this way, the fall in prices of Indian oil was checked for the time being. This arrangement however, did not last long. U.S.A., was one of the important buyers for Indian sandalwood oil. Although, there was an import duty of 20 per cent, it was not charged on the sandalwood oil imported from India. This facilitated Indian sandalwood oil to compete with the other countries operating in U.S.A. markets. However, the import duty on oil was further increased from 20 per cent to 25 per cent in Sept. 1922. The Mysore Government, therefore, entered into an agreement with M/s. Bush & Co., in New York to distill the oil in U.S.A., on its behalf from the wood exported by the Mysore Government. The distillation of sandalwood from Mysore Government was started in U.S.A. in 1925.

During this period, oil of sandalwood from a number of species was also available in the market. But in spite of this, India maintained its monopoly in this trade till 1950. Later on, Indian Government banned the export of sandalwood with the result, no export of sandalwood could be possible to U.S.A.

The U.S.A. which was the major buyer of sandalwood entered into collaboration with a German firm for setting up oil industry in Indonesia and started producing about 6 to 7 tonnes of sandalwood oil. Now it is reported that they are selling it at cheaper rates than Indian sandalwood oil.

In Indonesia* there are two factories situated in Kupang. Their production of sandalwood oil during 1978 was reported to be about 6 tonnes each. These two units have a total export potential of about 30 tonnes** of sandalwood oil per annum. During early 1920, the quality of Indonesian sandalwood oil was very much inferior as Indonesian factories were distilling the heartwood alongwith the bark and sapwood. But after acquiring the technical know-how from U.S.A. and Germany, the factories in Indonesia are reported to be producing quality

*Seventh International Congress on Essential Oils held in Kyoto, Japan in 1971 - Essential Oil situation in Indonesia by Dr. H.L. Ton.

**Newsletter by National Agency for Export Development, Deptt. of Trade (B.P.E.L.) Jakarta.

oil which is almost similar to that of the East-Indian sandalwood oil. Thus Indonesia has emerged as a new competitor to India in the world markets. The sandalwood oil imported from Indonesia being cheaper, U.S.A., is prompted to import bulk of its requirements from Indonesia.

It has also been reported that a firm namely, Singapore Essential Oils Distillation Ltd., Singapore has also come up in November, 1967 and now it is distilling sandalwood oil from sandalwood chips obtained mainly from Indonesia. They are exporting the sandalwood oil to West-European countries and their production capacity is stated to be 6 to 10 tonnes per annum. Another firm namely Indah Co. Ltd., (I.C.L.) was also established in Singapore (Jurong) as a Joint venture with Singapore in early 1969 by Mr. Tsai, a businessman from Indonesia, (In Indonesian Language Indah means beautiful.) This factory has a total distillation capacity of 18,000 litres of sandalwood oil and envisages a production of 20,000 liters of sandalwood oil per annum in the near future. The oil so obtained is reported by a London analyst as "in our opinion this is a genuine sandalwood oil of East-Indian type" and is satisfying the requirements of British Standards specification No. 2999/30.1939". Singapore is reported to be going better in production of sandalwood oil. Some Chinese interests in Singapore have installed stainless steel equipments and as a result are offering a comparatively better produce to U.S. markets. They are also offering a variety called U.S.P. oil with over 90 per cent of santalol contents as total alcohols. Singapore firm has installed a stainless steel equipment which was supplied by M/s. Volkart Bros. Ceylon.

Yugoslavia* is another new exporter though their performance in 1970 was reported to be not so high as it was in 1969, when they exported 7855 lbs. of oil. But it is reported that Yugoslavia has no indigenous sandalwood oil.

Nepal also made some shipments of sandalwood oil, but the interest of buyers appears to be falling off in their produce. Market sources confirmed that most suppliers do not appear to have Agmark certification which in other words explains the establishment of Indian quality mark.

Apart from Indonesian sandalwood oil, New Caledonian sandalwood oil has also entered the world market and is competing with the sandalwood oil of Indian origin. However,

*Ext. Soap perfumery and Cosmetics Journal. Singapore distilled essential oil Sept. 1970.

the detailed information on new Caledonian sandalwood oil is not readily available. A general trend in the sandalwood oil trade can be seen from Table No. 1.1:

TABLE 1.1
Import of Sandalwood Oil by U.S.A. during 1977 to 1979 and Jan—March 1980*

From	Qty. Kg. Value 000* US Dollars					
	1977		1978		1979	
	Qty.	Value	Qty.	Value	Qty.	Value
France	4,249	412.2	2,837	343.6	1,622	173.8
India	31,482	3899.6	26,186	2960.3	16,653	1939.7
Indonesia	14,489	1601.0	10,449	1038.4	13,300	961.2
Singapore	771	116.7	..	..	..	..
Sri Lanka . . . . .	..	..	380	35.7	100	8.9
Switzerland	305	47.5	355	42.7	69	2.1
U.A.E. . . . .	..	..	..	..	50	5.0
U.K.	500	44.9	..	..	23	2.2
Total	51,796	6121.9	40,207	4420.7	31,817	3092.9

	Jan.—March 1979		Jan.—March 1980	
	Qty.	Value	Qty.	Value
India	5,610	646.8	1,136	123.0
Indonesia	2,304	221.4	2,404	205.0
Other countries	537	58.8	166	72.0
Total	8,451	927.0	3,706	400.0

From this table, it can be seen that Indonesia is the strongest competitor against India in respect of sandalwood oil.

1.2. 2 India

Distillation of sandalwood by ordinary country stills only was known upto the period of World War II. The same procedure was also followed in South India in and around the Mysore State and other places for centuries. During World War II the export of sandalwood oil was disrupted badly which proved blessing in disguise. The large stocks of sandalwood were accumulated with them, and the falling prices, forced the Mysore Govt. to take the initiative to install a factory in the year 1915 under the advice of the Director of Industries, Mysore. Dr. Watson and Sudborough tried the production of sandalwood oil by steam distillation method. The experiments were carried out in the Indian Institute of Science, Bangalore on a pilot plant scale. The first factory was started at Bangalore in May, 1916 and the other at Mysore in 1917. Since then, the Mysore Government stopped auctioning of sandalwood in 1917. By 1921, for every tonne of sandalwood distilled and sold as oil, the State Government, it is estimated, obtained nearly 50 per cent more price than the auction price of one tonne of sandalwood than in the Madras and Coorg States. The pace of development in the distillation of sandalwood was at that time pulsating with enterprise. This attracted attention of other Indian distillers, some of whom started factories with modern techniques of steam distillation. One such factory was started at Kuppam (Andhra Pradesh) and another at Kannauj near Kanpur by the year 1921. Thus the Mysore Govt's factories were the pioneers in modern distillation of sandalwood oil and they made all sort of experiments in evolving new methods of distillation. In 1930, high pressure steam distillation was tried. This gave higher output and was more economical, saving both time and fuel. Hence, the work of both the factories at Bangalore and Mysore could be done by only one factory. The Bangalore factory was therefore, closed by the end of 1930 and was never revived again. After sometime, however, complaints started from foreign buyers regarding the deterioration in quality of the oil and hence the Mysore factory had to revert to the original process of low pressure steam distillation. Later on, the Mysore Government started another factory at Shimoga with a supplementary distilling at Bhadravati where surplus steam was available.

By the opening of sandalwood oil factories in Mysore, a firm foundation of this industry was laid in the country and from that very time, they continued to flourish. The sandalwood oil trade was a lucrative one that attracted the other businessmen also to enter into this trade. The result was that after 1930,

three more factories i.e. two at Mettur Dam and one at Salem came into existence. In 1932 M/s Sorabji Nowroji also established a factory in Bombay with a capacity of about 3 tonnes. Thereafter, seven more factories came up in Kerala during 1960-70. Of these, three were situated in Wynad, one at Manarghat, one at Kasargod and two near the Kerala-Karnataka border. In Uttar Pradesh, it is stated that there are three factories in working order in Kanpur at present, while 8 are running in Kannauj. Thus 11 factories are in operation in U.P. State. Two new factories have also been established in Delhi where one has started production and is stated to have produced about 100 kgs. of sandalwood oil during 1981. The other factory is yet to start production.

2. PRODUCTION OF SANDAL WOOD OIL

2.1 Production in the World—

No recorded information is available regarding the exact production of sandalwood oil in the world. According to an estimate, the demand is expected to be about 180 to 200 tonnes. Up to the year 1958-59, India was meeting the world's sandalwood oil requirement to the extent of 90 per cent. Other countries like Indonesia, Singapore, New Caledonia, Mauritius, West Indies, Africa and Malaysia had not started the exploitation of their sandal forests on large scale. Thus India was maintaining its monopoly in the sandalwood oil trade. From the beginning of the sixth decade of this century, these countries have also come up in the world markets with their new products. The quality of the product (sandalwood oil) offered by these countries except Indonesia, Malaysia, Singapore and New Caledonia, is inferior as compared with the East Indian sandalwood oil. In the early sixties, U.S.A. was the main buyer of Indian sandalwood oil which has partially switched over to other sources. This had caused a little set-back in the beginning for Indian sandalwood oil trade. But Indian sandalwood oil could withstand it for its quality and maintained its reputation and fame in the world market. That is why, this oil is still being sold at a higher price than the produce offered by other countries of the World.

In the early sixties, Western Australia was competing India but could not stand due to inferior quality of their sandalwood oil. Indonesia also was not offering stiff competition in those days because they were lacking in technical know-how. They have now acquired technical know-how by collaboration with American and German firms who have installed distillation factories in this region. The oil thus obtained from this region is comparatively cheaper than the Indian sandalwood oil. It is pertinent to note that these new countries have come up as strong competitors against India and the production of sandalwood oil in India is declining very fast. It can be seen from Annexure I. The production of sandalwood oil in India which was about 165 tonnes in the year 1969-70 has dwindled to about 69 tonnes in the year 1979-80.

In the world markets, a new substitute (A product commercially synthesised and commonly known as Sandela) has also

entered and is available at cheaper rates than common sandalwood oil offered by any country. But it has got certain limitations. Hence the trade is not so much after the sandela. It is being used only in the cheap oriental types of perfumes. Chemical hazards of this substitute have not yet been studied.

2.2 Production in India

The reliable data on the exact production of oil of sandalwood in India is not available. However, an effort has been made to estimate it state-wise as well as region-wise. The production of oil of sandalwood in India and the contribution made by different major States is illustrated in Graph No. 1.

The data on the annual production of sandalwood oil in India for the years 1963-64 to 1980-81 are illustrated in Annexure I. It can be seen that Karnataka contributed to the extent of about 74 per cent to the total production of sandalwood oil in India in the year 1963-64 when its production was about 116.29 tonnes. In the year 1969-70, it reached the peak when India produced about 165 tonnes of sandalwood oil. The contribution of Karnataka State was about 73 per cent and Andhra Pradesh contributed around 11 per cent while Tamilnadu and Uttar Pradesh contributed only about 5.2 and 9.1 per cent respectively. After 1969-70, the country's production looked downward and it decreased to about 156 tonnes in 1970-71. In the year 1972-73 it increased slightly to 163 tonnes. Thereafter, the production declined continuously to be 133, 97.73 and 90 tonnes during 1973-74, 1975-76 and 1976-77 respectively. In 1977-78 about 112 tonnes of sandalwood oil was estimated to be produced in the country. But during 1978-79 and 1979-80, the trend remained downward with production declining to only 82 and 69 tonnes respectively.

2.3 Number of Factories and Stills in Operation in India

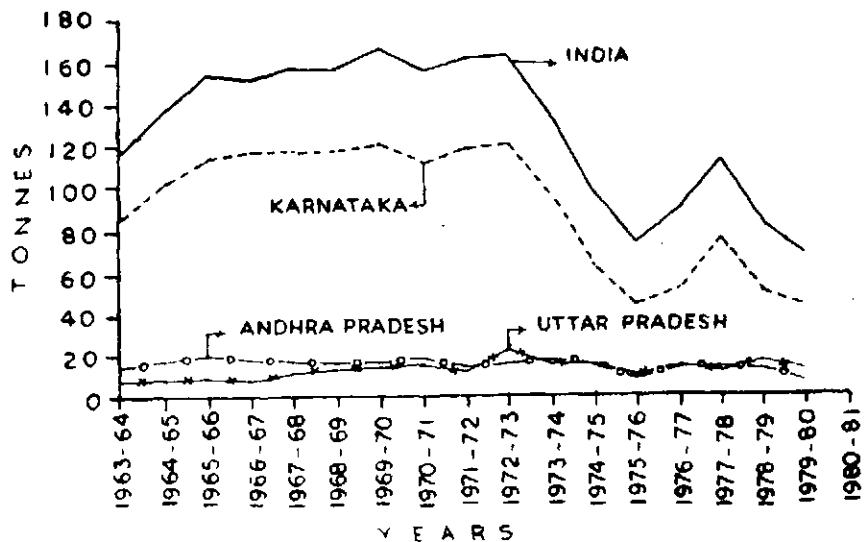
At present, the total number of factories engaged in distilling sandalwood in India by modern steam distillation technique are 32 as given in Annexure IX. These are not working to their full capacity for various reasons such as insufficient availability of sandalwood, inadequate supply of coal, economic difficulties etc.

It will be seen from Annexure IX that the capacity of the private factories comprising of Sl. No. 3 to 32 (total 83.75 tonnes) is almost double to the production capacity in the public sector comprising of Sl. No. 1 and 2 (total 42 tonnes). Thus,

GRAPH No. 1

ESTIMATED PRODUCTION OF SANDALWOOD OIL
IN INDIA AND MAJOR CONTRIBUTING STATES.

FOR THE YEARS 1963-64 TO 1980-81



while the private factories taken together can distill about 7000 tonnes of wood a year, the actual quantity of sandalwood available to them is between 1200 to 1800 tonnes, out of which nearly 300 to 500 tonnes are exported leaving behind 900 to 1300 tonnes for distillation. Thus, the installed capacity is 4 to 5 times more than the wood available for its distillation. Till 1960, there were only 15 private factories those have distilling capacity of about 45 tonnes and have now increased to 30 in number having total capacity of about 84 tonnes per year. This has further generated a very keen competition in the trade.

3. EXTRACTION OF SANDALWOOD OIL

3.1 Conventional Method

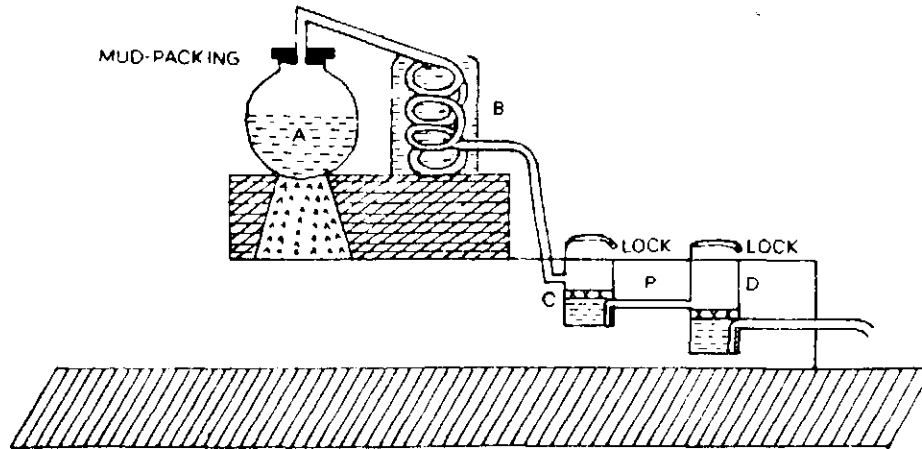
Water distillation of sandalwood to produce essential oil was being carried out as a craft in this country from ancient times. With the simplest of techniques and apparatus high quality sandalwood oil was produced in small quantities. It was done by a typical unit consisting of a copper still which would take 18 to 27 kgs. of the wood reduced to a fine powder. The powder was soaked in water for about 48 hours and then distilled with water over an open fire; the vapours condensed after passing through a bamboo or copper tube in the receiver(s) kept immersed in cold water. Kannauj was a major producing centre for this oil. In the past, about a tonne of sandalwood commercially known as "Bombay sandalwood", used to be transported every year to Kannauj via Mathura on camel backs and was distributed to different distillers in quantities of about 75 kgs. each. The oil so obtained was known as 'Bhatti Oil' and is still claimed to possess a finer odour than that produced in modern stills.

3.2 Hydro distillation method

There are two methods in vogue for distillation of sandalwood. These are commonly known as hydro distillation and steam distillation. Hydro distillation technique is nothing but a modification of the conventional method. In this method, sandalwood is cut into thin chips with axes by manual labour and the chips are soaked in a small water tank for about 10 to 15 days. 20 to 30 kg. of chips are then transferred to a thick copper vessel [A] (Please see figure on opposite page) with about 90 kgs of water. The neck of the copper vessel is joined to a bamboo or copper pipe by means of mud and the same is led into a spiral copper condenser surrounded by water kept in a galvanised iron drum [B]. The cold [C] water in the drum is changed periodically to facilitate fast cooling of the distillate. The florentine receiver [C] is kept partly under-ground with locking arrangements. The condensate moves from the receiver [C] to another similar receiver [D] which is also kept locked. The connecting pipe [P] is generally kept underground so that a worker can have space to walk freely in the shed in which a battery of such stills is working.

ILLUSTRATION No. 1

WATER DISTILLATION OF SANDALWOOD



A _ THICK COPPER VESSEL

B _ GALVANISED IRON DRUM CONTAINING WATER

C. D. FLORENTINE RECEIVERS

P _ CONNECTING PIPE

The copper vessel or the still is heated on open fire. Vapours of water and oil pass through the condenser into the receiver [C] where the oil floats on top and is scooped out after a week or so. As the lower layer of water continuously moves to receiver [D], the residual oil contained therein takes more time to float on top and is collected. The distillation goes on continuously for 30 days. From the quantity of water added and that condensed, it is possible to check the condition of the still and to know if it contains sufficient water. This has to be observed carefully otherwise it may lead to charring of wood which gives a bad smell to the oil. The collected oil is allowed to settle and is decanted and marketed straight away as 'bhatti oil'. In this method, the oil obtained has a very superior odour but the yield is less by about 0.5 to 1 per cent and the process is very time-consuming. This method has become obsolete being uneconomical. Therefore, it has been abandoned by the trade.

3.3 Steam Distillation

In modern factories, bigger pieces of the wood are split into smaller ones in a wood splitting machine. The pieces of wood which are classed as roots, billets and chips are then fed into a chipping machine, the radically moving blades of which convert the same into small chips. These chips are in turn converted into powder by means of a disintegrator. (Please see figure No. 2). The powder is sieved through a particular mesh so that it is neither too fine nor too coarse. The particular size of the mesh is important to form a uniformly porous body for steam to pass through very fine powder, which may be about 0.1 per cent, is collected in balloons of jute cloth attached to the disintegrator and is not used for distillation. It is known as 'Balloon dust' and is sold at a high price to cosmetic manufacturers.

Sandalwood powder is charged into a still, filling $\frac{5}{6}$ th to $\frac{7}{8}$ th of its capacity. A still is generally made of copper and is provided with a false bottom. Oil vapours and steam are conducted through the goose neck to a cylindrical tubular condenser made of copper (See illustration No. 3). The surface coming in contact with the oil vapours is tin lined.

Steam stills are of different sizes holding $\frac{1}{2}$ to 2 tonnes of sandalwood powder. With private factories the half-tonne size is popular while in Karnataka Government factories two tonne size stills are used. The height of a still is generally 25 per cent more than its diameter [See figures 4(a) & 4(b)] Stills with height twice



Disintegration of Sandalwood

CONDENSER USED BY PRIVATE FACTORIES

(THIS IS DIFFERENT FROM THE MYSORE TYPE AS SHOWN IN FLOW SHEET DIAGRAM)

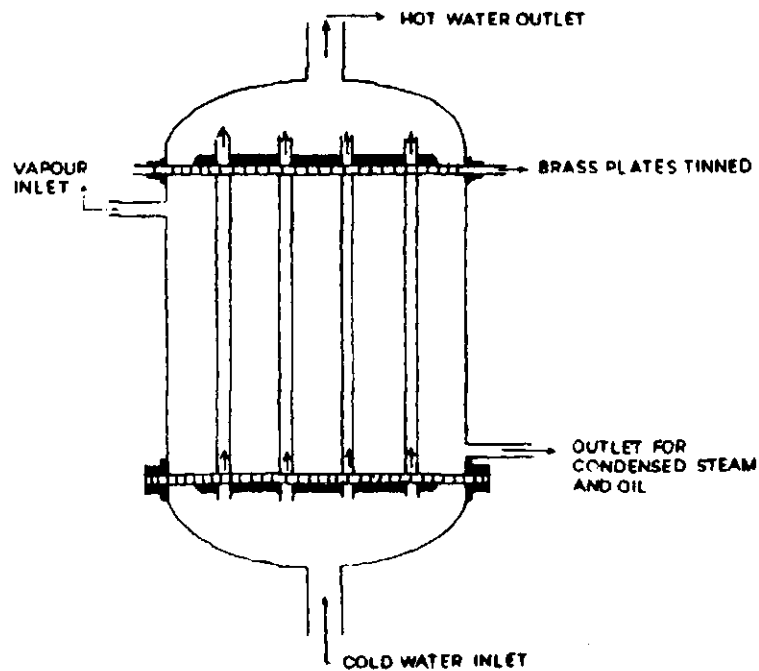
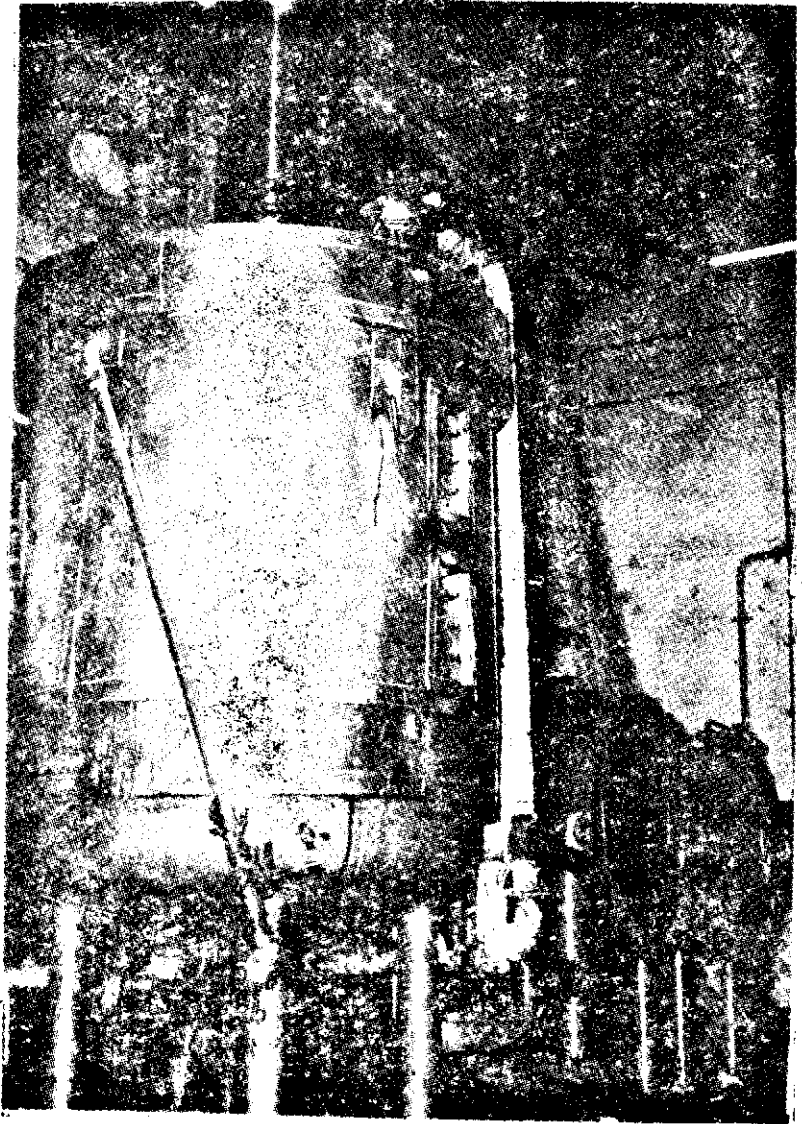
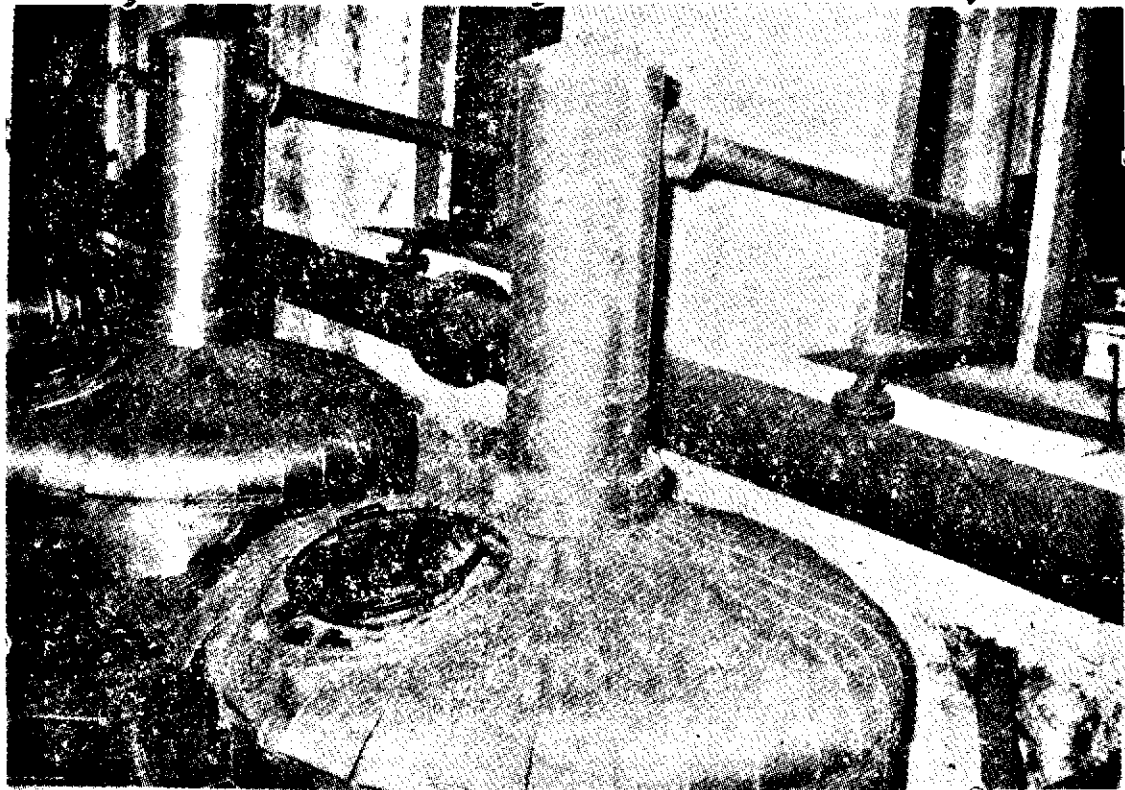


ILLUSTRATION NO. 4 (a)

**Distillation of Sandalwood**



Distillation of Sandalwood

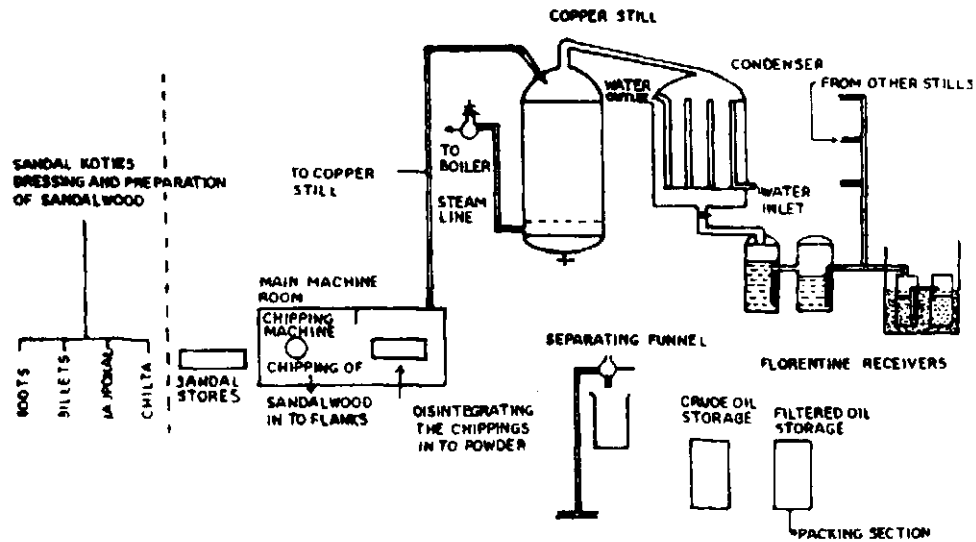
or more the size of diameter are also in use but for these it is very important that the powder is properly packed. If this is not done properly, the steam forming channels will not be distributed throughout the mesh uniformly and the efficiency of distillation will suffer. The receivers are of the florantine type and are tinned. A set of two receivers is connected to each condenser. The oil floats on top and is scooped out periodically. Water is continuously siphoned off from the first receiver to the second by means of a tube, where further separation takes place. Water from the second receiver of all the stills is collected in another set of two or three receivers kept in a tank of cold water to have further separation. In this way, the distillate may pass through five to eight receivers. Flow sheet diagram (Illustration No. 5) gives an idea of this process.

The time required for distillation varies from factory to factory. In some factories where the capacity of the condensers is large (such as Mysore), the time required for distillation is 72 hours. In others, it may vary from 96 to 120 hours depending upon the class of wood and the particular mesh size of the powder used. Distillation of roots, which contain more oil, usually requires longer time than chips. A factory processing only chips requires 96 hours for distillation and while using roots, it may require 120 hours. The distillation continues till it ceases to be economical. It is estimated that approximately 1300 litres of distillate is collected from one tonne of sandalwood. This large amount of separated water contains traces of sandalwood oil which use to go as a waste. It has been reported that now the Karnataka Soap and Detergent Limited has succeeded in developing a technique to take out even these traces of sandalwood oil. In this technique, the distilled water is circulated over the spentwood powder to recover all the traces of the oil. This process has increased their production as well as reduced the cost of distillation. The distillation is generally done with low pressure steam between 20 to 40 lbs. per sq. inch at the regulating valve*.

It is stated that most of the sandalwood oil of some consequence is obtained by steam distillation at 30° to 40°C (room temperature). It is stated that during the process of distillation as many as 200 constituents are formed. When the oil is sub-

*Mr. S. Narain, Srimathi R.A., Srinath and Mr. K.R. Venkatesan, Sandal Research Centre, Bangalore have reported that the distillation is done for 01 to 120 hours per tonne of powder at a pressure of 0.232 kg per sq. cm.

FLOW SHEET DIAGRAM OF A SANDALWOOD OIL FACTORY



jected to steam distillation at high pressure, it has a hydro-cycling effect and sandalwood oil thus obtained would not be identical with that which occurs in a plant. This is not very much appreciated by trade. The steam distillation technique is more manageable and is being followed nearly by 95 to 98 per cent of the distilleries.

Coal is the common fuel used by most of the distilleries. But Bangalore distilleries have used the furnace oil also for the boilers in the distillation of sandalwood oil. Since the cost of furnace oil is quite high, mostly coal is preferred. Fire wood was also used for distillation purposes but was found unsuitable by the distillers as it was time-consuming and uneconomical.

The distillate is collected in receivers which are kept locked and sealed. The oil is scooped out from time to time and collected in a holding tank. The bulked oil is then warmed to remove moisture and is filtered through steam jacketed funnel using filter cloth and is marketed as such. Oil of sandalwood after removal of moisture and after filtration looks pale yellow to reddish in colour and is optically clear. The oil is also subjected to rectification for better quality.

3.4 Solvent Extraction Process

It is stated that a process for solvent extraction of sandalwood oil was investigated at the Central Food Technical Research Institute.¹ Subsequently, the product obtained by this process was examined by a number of important users of sandalwood oil in India. They pronounced it to be superior than a product being marketed.

In the new process of solvent extraction the finally comminuted wood is extracted in specially designed extractors by a selected hydrocarbon solvent to obtain a "concrete". The "concrete" itself may be directly employed in perfume formulations, especially in soaps, to great advantage. This is further processed to obtain more refined products to suit the special requirement of large users. High vacuum distillation with or without a preliminary liquid/liquid extraction with alcohol and the process using column chromatography for separations are some of the chemical engineering techniques that have been employed. It has thus been found possible to obtain products tailored to the requirements of specific large users.

¹B. H. Krishna, Consulting Chemical Engineer investigated the process of solvent extraction of Sandalwood oil when he was associated with CFTRI, Mysore.

3.5 Other method

It has been reported* that the Russians have evolved a continuous distillation method of essential oils. It is stated that the distillation of essential oils is carried out by means of three interlocking work drives without interrupting the procedure. Such innovations are of considerable interest to the technicians (distillers) and efforts should be made to introduce such techniques in our country.

3.6 Rectification of Oil

Sandalwood oil obtained on distillation contains a number of terpenes in it. Especially, the first fraction of sandalwood oil after start of distillation has higher terpene contents due to which sandalwood oil has lesser santalol content resulting in poor quality. Besides this, moisture is also required to be removed from sandalwood oil. The oil obtained after distillation sometimes does not conform to specifications prescribing a minimum of 90 per cent santalol as total free alcohol. As 90 per cent santalol is the limit prescribed in most of the standards, it is obvious that the oil containing less than 90 per cent santalol as free alcohol cannot be marketed as such. That is why it becomes necessary not only to make a judicious selection of sandalwood for distillation, but also to carry out rectification to remove the fractions richer in terpenes.

The rectification of sandalwood oil can be done in two different ways *i.e.* direct and indirect. For direct rectification the oil is condensed in a condensing pot which is comprised of oil as well as moisture and is termed as crude sandalwood oil. This oil is redistilled to improve the colour and quality. In this process, the crude oil is charged into preheated redistillation plant. The super-heated steam is then slowly led into the still. During the super-heating, the first 2 per cent fraction which is richer in terpenes is separated. The oil is heated in a steam jacketed vacuum still to remove last traces of water and is filtered under vacuum. This oil is invariably of high quality and conforms to the standards. The redistillation of oil takes place at about 200°C and the oil thus collected is put into further processing. The terpene rich fraction and the residue are sold

*High-lights of Sandalwood Oil industry in Mysore State by Shri B.K. Thangappa, Govt. Soap Factory, Bangalore.

at lower prices for use in *attar* manufactures etc. The Mysore Govt. factory which is the largest sandalwood distillery in the world and is equipped with all mechanical and chemical engineering equipments, uses this process for rectification.

The indirect rectification is usually carried out with the first distillation itself. Thus, in some factories the forcruns of the oil distilled in the first one or two hours from each still are removed separately and not added to the rest of the oil in the holding tank, as they are richer in terpenes. Similarly, the oil from the last florantine receivers which is generally more reddish in colour because of its longer contact with metallic pipes etc. is also removed separately. This process of rectification through the application of 'cuts' in distillation is quite popular with most of the factories in the country as it does not require any special equipment.

Sandalwood roots, as has been stated earlier, give the highest yield of oil, *i.e.* 53 to 62 kgs. per metric tonne. But the santalol content (as total free alcohol) of such oil is said to be in the neighbourhood of 90 per cent or even less. Hence, the oil distilled exclusively from roots may or may not have 90 per cent santalol as free alcohol. Sandalwood chips yield less oil but the free santalol content of the oil is said to be between 90 to 94 per cent. Billets are considered to be in between the two in this respect. Thus, by a careful selection of the wood, it may be possible to produce oil with 90 per cent or more santalol as total free alcohol.

Usually, at the time of distillation first 1 to 2 kgs. of oil that comes out in the beginning of distillation which are terpenes with green colour, is removed. Similarly, the last fraction about 1 to 1.5 per cent of the total distillate known as red oil is also not added to the sandalwood oil. Both terpenes and red oil are insoluble in 70 per cent of alcohol while terpenes and red oil give a low santalol (57 to 63 per cent) and low sp. gr. (0.968—0.973 at 30°/30°C) and red oil has more sp. gravity. Usually first and last fractions of oil (1 to 2 per cent each on both sides) are removed and sold separately as terpenes and red oil. It is stated that oil distilled from diseased wood gives a little sour note.

3.7 Disposal of exhausted wood

After the recovery of sandalwood oil, a bye-product in the form of exhausted sandalwood powder is obtained. In the past it was generally burnt as a fuel in the boilers. Later on, it was

found that it has got a high fire holding character, hence it was introduced in the manufacturing of *agarbattis* and has become a regular practice. This powder even after exhaustion contains some quantity of residual oil and is stated to be capable to hold the fragrance for a longer period. Hence it is preferred by the *agarbatti* manufacturers. The price of exhausted powder varied from Rs. 200 to Rs. 400 per tonne depending upon its oil content, particle size and its demand. The finer variety of exhausted powder is also used for blending in smoking tobacco.

General availability of this exhausted powder is found about 90 per cent of wood used for distillation. It was stated that in Karnataka there was a good demand for this exhausted powder as there are a number of *agarbatti* manufacturing factories, which mix this spent dust alongwith perfumes. Approximately 30 to 50 tonnes of spent dust was sold annually by Tamilnadu distillers and about 20 to 25 tonnes by Kuppam centre distillers. In Uttar Pradesh, a small quantity of this powder was utilised for the manufacturing of *agarbattis*. Rest of the dust (exhausted powder) was used as a fuel, while in Delhi the entire exhausted powder was consumed by the *agarbatti* manufacturers. The supply of exhausted powder was not sufficient to meet the requirements of *agarbatti* manufacturers in Delhi. On the contrary in Maharashtra, specially in Bombay it was stated that lot of spent sandalwood powder remains unsold and the manufacturers of oils sometimes felt it difficult to dispose it of.

Thus, the waste products have found an outlet for manufacturing of good products and we are now exporting *agarbattis* prepared from it to different countries and are earning handsome foreign exchange. Secondly, a general demand for this spent/exhausted powder has engendered in foreign market with the result India had exported the large quantities of it to different countries and thus earned a good amount of foreign exchange. Therefore, the sources are to be tapped further by making proper enquiries etc.

There is another bye-product obtained after the disintegration of wood for distillation. This is known as the balloon powder *i.e.* super-fine powder that escapes at the time of powdering the chips/wood by disintegrators. It is collected in plastic bags and is sold to cosmetic manufacturers at a handsome price round about 75 to 80 rupees a kilogram. These bye-products are generally sold through negotiations. No organised marketing has established for these bye-products so far.

Spentwood Exports*

Qty. in tonnes

Value in rupees

Countries	Years									
	1976-77		1977-78		1978-79		1979-80		1980-81	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
Japan .	96	101972	130	176645	110	164215	20	30498	50	92326
Singapore	19	17081	..	..	..	..	..	..	..	..
Dubai .	..	..	..	..	..	..	..	..	..	..

Source :—Personal enquiries with the Karnataka Soaps and Detergents Ltd., Bangalore.

*It can be seen that Japan has come out as a major buyer for our exhausted sandalwood powder.

4. UTILISATION OF SANDALWOOD OIL

India has been the major exporter of sandalwood oil in the world market. About 50 to 60 per cent of the world's requirement was met from Indian exports. Sandalwood oil contains a mixture of two sesquiterpene alcohols having an empirical formulae $C_{15}H_{24}O$, which are chemically known as α and β santalols. These two constituents have been proved to be responsible for the medicinal as well as the perfumery value of the oil. The higher the santalol content of the oil, the better it is. East Indian oil of sandalwood has been known to contain upto 95 per cent free santalol. The oil is used in the treatment of gonorrhoea and gleet. In chronic cystitis, minute quantity of the oil with benzoic acid and boric acid have given good results. The oil has also been used successfully in urinary infections due to staphylococcus. In bronchitis, it is given in doses of a few drops on a lump of sugar. But certain more effective sulphadruugs and antibiotics have practically replaced oil of sandalwood in medical practice and henceforth the oil has not been included in the British Pharmacopoeia. It however, continues to be used in indigenous systems of medicine.

4.1 Exports

After the World War II, other countries have also appeared as new exporters of sandalwood oil to the world markets. However, the quantity and quality exported by Indian exporters remained at the highest.

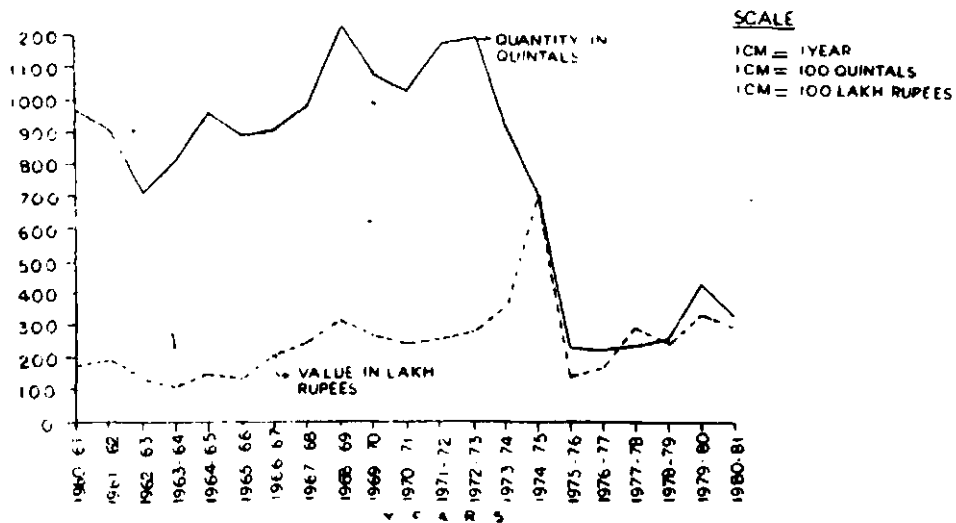
4.1.1 Quality

The quality of the oil exported by different countries are presented in Annexure II. From the Annexure, it may be seen that India is exporting the best quality of oil in the world markets and is still famous for its quality.

4.1.2 Quantity and Value:

India is exporting sandalwood oil to more than 40 countries of the world. Earlier to 1960, India was meeting the world's requirement upto the extent of about 70 to 80 per cent. The total Indian production was of the order of 125 to 200 tonnes. The production has now come down to about 70 tonnes of which about 64 per cent is still exported to different countries of the world. The quantity and value of exports from India

GRAPH No. 2
EXPORT OF SANDALWOOD OIL
 (1960-61 TO 1980-81)



for the years 1960-61 to 1980-81 are illustrated in Graph No. 2 and also given in table No. 4.1 below. Country-wise and year-wise quantity and value are given in Annexure III.

TABLE 4.1

Export of Sandalwood Oil for the years 1960-61 to 1980-81

Year	Quantity (in Qtls.)	Value in (000' Rs.)
1960-61	980	17408
1961-62	917	19321
1962-63	722	12854
1963-64	811	12290
1964-65	971	14519
1965-66	894	13466
1966-67	905	20426
1967-68	990	23610
1968-69	1230	31488
1969-70	1081	27476
1970-71	1038	24540
1971-72	1179	26099
1972-73	1199	27820
1973-74	927	35116
1974-75	714	70869
1975-76	227	13994
1976-77	224	16984
1977-78	226	28572
1978-79	253	24040
1979-80	430	34348
1980-81	371*	28839*

*(Provisional data)

Source : Indian Journal of Foreign Trade, Vol. I.

From the above table, it may be observed that the export of sandalwood oil during the 1st quinquennium *i.e.* 1960-61 to 1964-65 was at a declining trend. However, a general rising trend in the prices was observed. The export during the 1st quinquennium *i.e.* 1960-61 to 1964-65 was about 440 tonnes of which U.S.A. shared about 90 tonnes and U.K. was next to import about 77 tonnes of sandalwood oil from India. France imported about 76 tonnes during the quinquennium, while Japan

had restricted its import to only about 59 tonnes. U.S.S.R. was also not far behind and the import by this country was about 37 tonnes during this quinquennium.

During the second quinquennium *i.e.* 1965-66 to 1969-70, a different trend was observed. France took lead in import over U.S.A. The average yearly imports of these countries during this quinquennium were of the order of about 18 and 15 tonnes respectively. U.S.S.R. have also imported on an average about 13 tonnes of sandalwood oil per annum during this quinquennium and was the third important buyer of sandalwood oil in the world from India. U.K. imported only about 11 tonnes yearly on an average for this quinquennium compared to about 15 tonnes in the 1st quinquennium. During this quinquennium Netherland also appeared as a big buyer of sandalwood oil and its import was about 10 tonnes. Overall trend was found quite encouraging in this quinquennium and India could export sandalwood oil to the extent of 510 tonnes with an average of about 102 tonnes per year.

During the last years of the 3rd quinquennium (1970-71 to 1974-75), a slight decrease in export was observed. The total export of sandalwood oil was about 506 tonnes. U.S.A. was the top buyer. It imported about 30 tonnes per year on an average for the quinquennium and was second in the list. France imported about 14 tonnes of sandalwood oil *i.e.* about 4 tonnes less than the average annual import of earlier quinquennium. U.S.S.R., U.K. and Switzerland imported on an average per year about 13, 8 and 7 tonnes respectively. Thus U.S.A, France and U.S.S.R. were the prominent buyers of sandalwood oil from India in this quinquennium.

In the fourth quinquennium *i.e.* 1975-76 to 1979-80, the production of sandalwood oil declined steeply. Therefore, after meeting the internal requirements, only a small quantity could be exported to other countries of the world. U.S.A. was the prominent buyer to import about 8 tonnes of oil against their demand of the order of about 20 to 30 tonnes. On the other hand due to certain other developments, U.S.A. began to import oil from other countries. U.S.S.R. imported about 7 tonnes per annum on an average during this quinquennium while in the earlier quinquennium, the average import was of the order of 13 tonnes per year. France imported only about 3 tonnes per year on an average for this quinquennium.

In the entire export trade, the Mysore (Karnataka) Government factories played a major role. They exported about 231

tonnes of sandalwood oil worth Rs. 40.17 million during the quinquennium 1960-1964. This was about 53 per cent of the total exports. In the next quinquennium of 1965-1969 they exported 315 tonnes of sandalwood oil for which they realised foreign exchange of about Rs. 71.70 million to the country. Their contribution to the total export of sandalwood oil was about 61 per cent. They exported about 264 tonnes of sandalwood oil worth Rs. 88.56 million during the 3rd quinquennium *i.e.* 1970-74. The percentage share of the State declined to about 45 per cent. However, in the next quinquennium *i.e.* 1975-76 to 1979-80, the export of sandalwood oil declined further to be about 136 tonnes. In terms of value, they earned foreign exchange of the order of Rs. 110 million. During this quinquennium their share in sandalwood exports was about 57 per cent in terms of value. The overall position of sandalwood oil exports was a bit gloomy due to decline in the production. Also with the discovery of sulphadiazine and antibiotics, the medicinal use of oil of sandalwood decreased and since then, it has mainly been pressed for its use in perfumery. The introduction of new sandalwood oil by different countries also caused a competition by offering their produce at a lower price. Indian oil is considered to be much more superior in quality as compared to the other so-called oil of sandalwood. This has maintained the demand for the Indian oil further and India never felt any difficulty in selling its surplus production after meeting the internal requirements. Karnataka State still plays a dominant role in the export of sandalwood oil.

Oil of sandalwood has a very good market in internal trade. It is used widely for the manufacture of *attars*, perfumeries, soaps, cosmetics and *agarbattis* etc. Therefore, the export of the oil is very much related to internal demand as well as to the prices in the world markets. A look at the production and exports for the last five years reveals a declining trend in both.

4.1.3 Destinations

The distribution of exports of sandalwood oil, countrywise is given in Annexure III and percentage of export to the major countries has been tabulated in Table 4.2.

The percentage share of main countries in the export of sandalwood oil from India has been calculated quinquennium-wise on the basis of total quantity exported from India is illustrated in graph No 3. From the table it will be observed that U.S.A., U.S.S.R., France, U.K., Switzerland, Netherland, Sudan and Hungary have been the principal buyers of East-Indian Sandalwood Oil. Before the invention of sulphadiazine etc., oil of

TABLE 4.2

Country-wise per cent share in the export of Sandalwood Oil from India during 1970-71 to 1980-81

Sl. No.	Years	Countries							
		U.S.A.		U.S.S.R.		FRANCE		U.K.	
		Qty. %	Value %	Qty. %	Value %	Qty. %	Value %	Qty. %	Value %
1.	1970-71	13.07	12.89	15.83	15.4	11.49	12.02	8.10	8.76
2.	1971-72	27.84	26.94	11.84	11.09	14.35	14.68	7.16	9.91
3.	1972-73	36.31	36.56	7.92	7.56	16.32	16.14	10.01	10.28
4.	1973-74	37.41	42.64	7.55	7.33	13.52	11.76	6.96	6.21
5.	1974-75	33.70	33.61	23.88	21.40	16.33	16.73	5.18	5.04
6.	1975-76	29.42	24.02	32.75	42.42	6.14	5.22	1.39	1.41
7.	1976-77	38.52	39.13	20.36	19.54	16.78	17.71	6.53	6.80
8.	1977-78	36.54	36.77	30.25	30.16	4.52	4.00	2.47	2.62
9.	1978-79	34.28	32.41	16.21	15.12	14.10	13.38	3.24	3.08
10.	1979-80	18.07	19.09	28.30	20.66	15.62	16.22	7.91	9.12
11.	1980-81*	12.14	13.38	..	..	9.45	10.22	..	..

*Provisional.

TABLE 4.2 -Contd.

Country-wise per cent share in the export of Sandalwood Oil from India during the 1970-71 to 1980-81

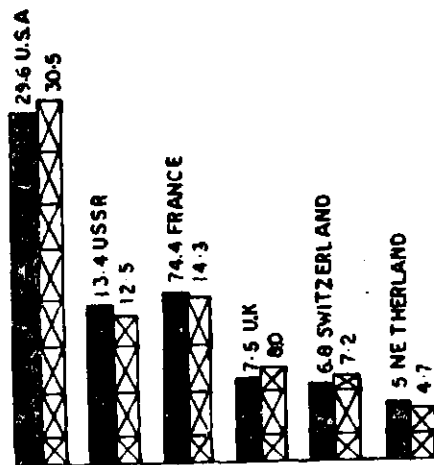
Sl. No.	Years	Countries									
		SWITZERLAND		NEITHER- LAND		SUDAN		HUNGARY		OTHERS	
		Qty. %	Value %	Qty. %	Value %	Qty. %	Value %	Qty. %	Value %	Qty. %	Value %
1.	1970-71	8.39	8.77	10.34	9.77	6.83	6.6	2.15	2.23	23.80	23.56
2.	1971-72	5.81	5.95	3.19	3.18	4.73	5.18	2.81	2.75	22.27	20.32
3.	1972-73	6.71	6.65	4.69	4.66	2.73	2.89	3.32	3.09	11.99	12.17
4.	1973-74	4.53	4.25	5.50	4.56	1.26	0.88	6.09	5.03	17.18	17.34
5.	1974-75	8.75	10.46	1.45	1.44	1.06	1.06	2.23	2.41	7.42	7.85
6.	1975-76	0.16	0.15	0.26	0.24	2.67	2.61	5.29	3.53	21.92	20.04
7.	1976-77	1.79	2.16	0.45	0.63	2.69	2.44	2.78	2.07	10.10	9.52
8.	1977-78	3.64	3.80	0.73	0.68	6.30	6.58	2.20	2.29	13.35	13.03
9.	1978-79	3.56	4.44	0.40	0.34	10.21	12.42	..	..	18.09	18.81
10.	1979-80	5.88	6.67	1.56	1.53	6.63	8.45	..	..	16.03	18.26
11.	1980-81*	..	..	..	..	..	..	..	..	..	..

*Provisional.

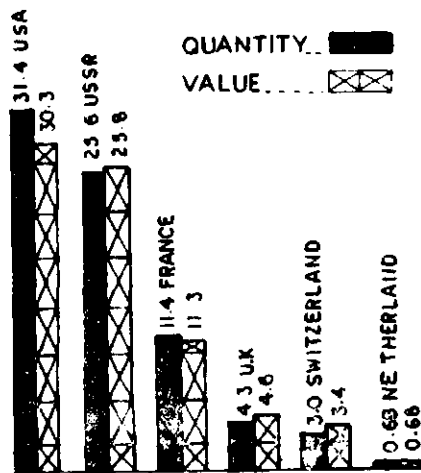
GRAPH No. 3

PERCENTAGE SHARE OF MAJOR IMPORTING COUNTRIES.

QUINQUENNIUM
1970-71 TO 1974-75



QUINQUENNIUM
1975-76 TO 1979-80



sandalwood used to go to almost all important countries of the world directly or indirectly from India. With the change in the consumption pattern, the trade pattern has also been changed. Now the countries using it for perfumery purposes are the principal buyers. The USA's share in the total imports was 13.07 per cent in 1970-71. This increased to 27.8 per cent during 1971-72. During 1972-73 and 1973-74, the percentage share has increased further to 36.31 and 37.41 per cent respectively. In 1973-74, there was a decline in terms of absolute quantity by about 20.3 per cent though in terms of value, this was higher by about 47.22 per cent. In the succeeding year, the export to USA declined both in terms of percentage as well as in quantity. During 1974-75, USA imported about 24 tonnes sandalwood oil worth Rs. 23.8 million which reduced to only about 7 tonnes in 1975-76, valued at about Rs. 3.4 million. In 1976-77, it imported from India about 8.6 tonnes of sandalwood oil worth Rs. 6.6 million. In 1977-78, there was a further decline in exports to USA to be about 8.3 tonnes, though an improvement in the price and total value realised at about 10.5 million rupees. In the year 1978-79 and 1979-80, the export was only about 8.7 and 7.8 tonnes valued at about 7.8 and 6.6 million rupees respectively. During 1980-81 the situation further worsened when the exports to USA came down to only about 4.5 tonnes fetching only about 3.8 million of rupees. Thus USA, which was the major buyer of Indian sandalwood oil has reduced its import from India. It is stated that USA has started its import of sandalwood oil from other countries. The general demand of USA for sandalwood is about 50 to 70 tonnes a year. Thus India suffered a great jolt in its export trade to USA.

USSR is the next principal buyer of East-Indian sandalwood oil. Its percentage share in export of sandalwood oil from India in 1970-71 was about 16 per cent which declined to 11.84 per cent in 1971-72 and about 8 per cent in 1972-73. However, in 1974-75 and 1975-76 the export to USSR increased in terms of percentage upto 23.08 per cent and 32.74 per cent respectively, but in terms of quantity it decreased. During 1975-76 and 1976-77, our exports to USSR declined further with the result the foreign exchange earnings declined substantially. During 1977-78 and 1978-79, the exports to USSR came down to only about 6.8 tonnes and 4.1 tonnes valued at Rs. 8.6 and 3.6 million rupees respectively. However, during 1979-80, the position improved when the exports increased to about 12.2 tonnes worth about 7 million rupees.

France was also another important buyer, which imported about 11.5 per cent of total export of sandalwood oil from India

in 1970-71. The general trend was at increase during 1971-72 and 1972-73. In these years, the quantitative increase in exports was observed. But thereafter, the quantity of export declined gradually. In 1974-75 it was about 11.7 tonnes valued at Rs. 11.8 million. In 1975-76 the quantity of sandalwood oil exported was further reduced to a bare 1.4 tonnes. The export to France did fetch only about Rs. 0.7 million in this year. Thus India lost significant amount of foreign exchange. During 1976-77 and 1977-78 the quantitative exports were 3.7 and 1.0 tonnes only which could fetch about 3 million and 1.1 million rupees respectively. The export of sandalwood oil to France during 1978-79 and 1979-80 was about 3.6 and 6.7 tonnes that fetched about 3.2 and 5.6 million rupees in respective years. Thus quantity of exports declined considerably to this country also. A major drawback for the decline in exports can be attributed to our low production because whatever marketable surplus was available after meeting internal demand, we had no difficulty in disposing of it at a competitive price in the world market.

Similar pattern was also observed regarding the export from India to other countries as can be seen from the export data given in Annexure III.

4.1.4 Transportation

The export of sandalwood oil takes place from four major ports of the country *i.e.* Bombay, Calcutta, Madras and Cochin. Very small quantity is exported through other ports. Major quantity of sandalwood oil is being exported by air from airports namely Bangalore, Bombay, Delhi and Madras. It is reported that about 70 to 80 per cent of sandalwood oil is exported by air-cargo. Since this is a costly commodity and due to fluctuation in prices the merchants prefer to import the sandalwood oil from India by air-cargo under cover of insurance etc.

4.2 Importance of Sandalwood oil in the essential oils export trade of India

The major essential oils exporting countries of the world are given in the Annexure IV with the total value of essential oils, perfumes etc. exported by them during the years 1974 to 1976. It will be seen that France is at the top in this trade followed by U.S.A. Even Brazil, the climatic conditions of which are quite similar to India, stands 7th in order of importance while India's share is negligible in the list of exporters. It was about 0.2 per cent in 1975. However, the general, situation of Indian import of essential oil is also similar in world trade.

A study of the export trade of India in Essential Oils perfumes and flavouring material as given in Annexure X-A for the past few years will show the importance of the oil of Sandalwood. The data on exports of important Essential Oils from India for the years 1975-76 to 1979-80 are presented in Table No. 4.3. It will be observed from the table that the importance of Sandalwood oil in the total Essential Oils export trade of India holds the first position in terms of value and is next only to oil of lemongrass in terms of quantity. On an average, sandalwood oil contributes about 8.9 per cent to the total quantity of Essential Oils exported from the country, while in terms of money value it contributes to the extent of about 55.4 per cent of the total foreign exchange earnings from essential oils. The average foreign exchange earnings from oil of sandalwood, per annum comes to about Rs. 2.36 crores. This much foreign exchange could be earned from sandalwood oil when our production had declined significantly. This would have been about rupees 10 crores by now provided we could have maintained our sandal-forests properly to get the sandalwood (as much as) we had been producing in the past.

4.3 Internal Consumption

Oil of sandalwood is the most important essential oil required in perfume formulations, cosmetics, beauty-aids and religious functions both at home and abroad. Its wonderful properties, leaving its own fragrance and adsorption of the fragrance of others when blended with, forms basis for all perfumes. This particular characteristic has put it at the highest esteem amongst the perfumery raw industrial products. The consumption of sandalwood oil is mainly in the following industries:--

- (1) Perfumery
- (2) *Attar* preparations
- (3) Soap and toiletries
- (4) Incence sticks
- (5) Medicines

4.3.1 *Perfumery*

The maximum consumption of essential oils in India is in perfumery and *Attar* industries. Perfumery consumes about 5 per cent of total production of sandalwood oil. Perfume manufacturers usually prefer sandalwood oil with santalol content more

TABLE 4.3

Export of essential oils from India during 1975-76 to 1979-80

Sl. No.	Name of Essential Oil	Quantity in Kg.						Percentage to average
		1975-76 Qty.	1976-77 Qty.	1977-78 Qty.	1978-79 Qty.	1979-80 Qty.	Average of 5 yrs. ending 1979-80	
1.	Lemongrass Oil . . .	373725	174415	149024	71578	249280	203604.41	60.46
2.	Sandalwood Oil . . .	22705	22351	22647	25293	43001	27199.4	8.88
3.	Palmarosa Oil . . .	9283	56370	21650	15764	14956	23684.6	7.7
4.	Eucalyptus Oil . . .	3680	51897	12964	1732	4805	15015.6	4.9
5.	Vetiver Oil . . .	425	550	200	200	406	356.2	0.12
6.	Otto Rose Oil . . .							
7.	Keora Oil . . .	..	..	300	528	3294	1374.0	00.45
8.	Clove Oil . . .	32	..	148	375	120	168.75	00.06
9.	Rosa Oil . . .	..	..	21717	..	48302	35009.5	11.43
Total of all Essential Oils . . .		409850	305583	222764	121356	364164	306332.45	100.00

TABLE 4.3—Contd.

Export of essential oils from India during 1975-76 to 1979-80—(Contd.)

(Quantity in Kg.)

4-1 DMU/Faridabad/84

Sl. No.	Name of Essential Oil	1975-76	1976-77	1977-78	1978-79	1979-80	Average of 5 years ending 1979-80	Percentage to average
		Value	Value	Value	Value	Value		
1.	Lemongrass Oil	20181406	11080333	9949636	5011358	17266861	12697918	29.8
2.	Sandalwood Oil	13993776	16984133	28572084	24039630	36347789	23587482	55.38
3.	Palmarosa Oil	1347403	4459376	2883677	3296953	2923440	2982170	7.01
4.	Eucalyptus Oil	164233	1623840	674518	120514	372429	591107	1.39
5.	Vetiver Oil	187000	208470	114000	109613	225660	168949	0.40
6.	Otto Rose Oil							
7.	Keora Oil . . . . .	..	..	24256	38921	301734	121637	6.29
8.	Clove Oil	1409	..	7995	20808	7630	9461	0.02
9.	Rosa Oil . . . . .	..	..	1411620	..	3456068	2433844	5.71
Total of all Essential Oils		35875229	34355152	44051062	32224521	58901611	42592568	100

than 90 per cent. Kannauj perfume manufacturers are well known to the world from the olden days. Other perfume manufacturers are settled mainly in Kanpur, Delhi, Bombay, Calcutta and Madras. The total consumption of sandalwood in perfumery is stated to be about 3 to 5 tonnes.

4.3.2 Attar preparations

The prominent centre of *Attar* manufacturing is Kannauj which is famous from the ancient times. About 70 per cent of the total consumption of sandalwood oil in India is used in *Attar* industries. These industries utilise about 25 to 30 tonnes of sandalwood oil every year. The method of preparing *Attar* consists of heating flowers mixed with water on open fire in copper vessels—connected to a pot containing natural sandalwood oil allowing the flower distillate to condense in the oil. The quality of *Attar* depends on the concentration of the natural flower oil in the oil of sandalwood. The proportion of natural flower oil to the sandalwood oil in *Attar* is always more. The flower oil is always blended and the odour of sandalwood oil is suppressed by blending suitably. *Attars* are perfumery blends like Hina, Gulbina, Kewra, Jasmine and others which are all based on sandalwood oil. These *Attars* and compounds are very famous in India and are mostly consumed in the manufacturing *agarbattis* or *dhoops* and *zarda* (chewing tobacco).

4.3.3 Soap and toileteries

Sandalwood oil is well-known for its fixative properties. It blends well with ionones and methyl-ionone based on compositions as well as with vetiver and patchouly essential oils. The sandalwood oil is widely used in soaps, cosmetics and toilet powders. According to an estimate, about 3 to 5 tonnes of sandalwood oil is used in the preparation of scented soap, face cream and toilet powders. This accounts for about 5 to 10 per cent of the total consumption of sandalwood oil in India.

4.3.4 Incence sticks or agarbattis

The manufacturers buy sandalwood oil locally for scenting *agarbattis* (a small proportions of natural oil is said to be preferred in addition to synthetics). Reputed *agarbattis* (Joss sticks) manufacturers use sandalwood oil as it can retain the perfumes for a longer period thereby improving the quality of perfumes as well as of joss sticks. These *agarbattis* are mostly used both in India and abroad, for keeping the environment under fragrance for a longer time. The total consumption of sandalwood oil in the manufacture of *Agarbattis* is about 0.2 tonnes only.

4.3.5 Medicines

Sandalwood oil found its use in medicines for a number of diseases and ailments. At one stage, santalols were described as venerols and before the introduction of sulfa drugs and antibiotics, sandalwood oil preparations were used in the treatment of venereal diseases. Sandalwood oil is also used in the indigenous system of medicines in India for the treatment of dysuria, cystitis, gonorrhoea, and diuretic, and also as antipyretic and antiscabies. Another use of sandalwood oil was stated to be in chronic bronchitis and in blood pressure disorders. It is also used for polishing and aerosol sprays. At present only about 5 to 8 per cent of the internal consumption of the oil is used for medicinal purposes.

The different classes of consumers in India prefer different types of sandalwood oil depending upon the quality of the product to be produced/manufactured by them. The perfumery industries prefer sandalwood oil of high santalol content. Such oil is nearly colourless and does not leave any stain on the articles when it is used. To obtain such oil, perfume manufacturers prefer only Agmark graded oil. The general appearance of the oil is pale-yellow or nearly colourless, free from sediments and suspended matter. The minimum santalol content is 90 per cent. Sometimes, the santalol content is found upto 93 per cent or even more. But this too is graded under 'A' grade only. Other classes of consumers do not stress over quality.

4.3.6 New Substitutes

A commercially synthesised product known as Sandela has appeared in the markets of western countries. It is being utilised in the cheap type of perfumes. It is imported from Switzerland and France. Sandela is not a natural essential oil. It has also been imported by Indian traders as aromatic chemical. This is being done purposefully by traders to get clearance from the customs authorities as the Government has banned the import of sandalwood oil or its substitute in the country, to safeguard the interests of sandalwood industry in the country. Further, it has been estimated that nearly 300 kgs. of sandela is being imported in the country and is used in the cheap type of perfumes. It is cheaper than sandalwood oil. Therefore, it affects directly the cost of perfume and is preferred by the traders.

The quantity of sandalwood oil consumption has slightly increased in the country. In Gujarat State, there was an import of sandalwood oil of the order of 200 to 300 kgs. It is now

stated to be only 80 to 100 kgs. The consumption of sandalwood oil in Gujarat State is mainly in the manufacture of hair-oils or the *agarbattis*, perfumes, snuffs and zarda (chewing tobacco). The major producing centre for these items is Ahmedabad. However, a few traders are also located in Rajkot and Vadodara. The finished products like hair-oils, perfumes and *Agarbattis* to the extent of about 40 per cent are exported to Gulf countries. It is also stated by some of the manufacturers that the 'Sandela' is in very much resemblance to the odour of sandalwood oil. The other possibilities of commercial manufacturing of santalol are started by some of the scientists, from Camphene and Tricyclenes being cheap raw-materials.

The overall demand of sandalwood oil for internal consumption in the country is of the order of about 40 to 50 tonnes annually.

5. PRICES

5.1 Wholesale prices in the world markets

Wholesale prices of sandalwood oil are mainly co-related with the quantum of its export from India in a particular year. These are generally governed by a simple principle of demand and supply. The actual users do not disclose the quantities required by them and similarly the actual prices at which shipments have been transacted from other countries will obviously not be divulged by any buyer. Major traders of sandalwood oil are situated in New York and U.K. In New York, transactions to the extent of 80 to 90 per cent are carried out by two firms namely M/s Polaroma Manufacturing Co. Inc. and M/s Biddle Sawyer Ltd. It is reported that the sandalwood oil from Indonesia and Singapore are generally offered at 10 to 20 per cent lower prices than that to Indian produce. It is estimated that U.S.A. imports about 50 to 70 tonnes of sandalwood oil to meet its annual requirements.

Indian sandalwood oil offered by M/s Karnataka Soap and Detergent Ltd. fetches highest price in comparison to the prices received by any other sandalwood oil exporters. The prices of sandalwood oil received by Indonesia, Singapore, New Caledonia and the Mysore Govt. for the years 1980-81 and 1981-82 (up to july' 81) are compiled in Table No. 5.1. This illustrates the true picture where the Indian produce stands in the world market.

A Singapore firm known as M/s Indian Company Pvt. Ltd. has contracted with M/s R. Sarant & Co. Ltd., 147 London Road, Kingston for the sale of their sandalwood oil and they have come across with some agreement to sell their produce in the world Market. It is also reported that they have imported substantial quantity from the above-firm but the prices received by them for their produce are comparatively lower than that of Indian produce for the various reasons discussed in the preceding pages.

TABLE 5.1

Wholesale prices of Sandalwood Oil in the international market during 1980-81 and 1981-82

	Mysore Govt. Sandalwood oil Rate per Kg.	Indonesian Sandalwood oil Rate per Kg.	New Caledonian Sandalwood Oil Rate per Kg.			
			LRs.	OR U.S.\$	in US\$	In US\$
1980-81						
Apr. 80	.	.	1070	133.75	92.50	85.00
May	.	.	1070	133.75	88.00	85.00
June	.	.	900	112.50	88.00	85.00
July	.	.	900	112.50	88.00	78.00
Aug.	.	.	900	112.50	88.00	78.00
Sept.	.	.	900	112.50	88.00	78.00
Oct.	.	.	900	112.50	88.00	78.00
Nov.	.	.	770	100.00	88.00	78.00
Dec.	.	.	770	100.00	85.00	78.00
Jan. 81	.	.	770	100.00	..	..
Feb.	.	.	770	100.00	..	..
Mar.	.	.	770	100.00	78.00	78.00
1981-82						
Apr. 81	.	.	770	100.00	76.00	72.00
May	.	.	770	100.00	80.00	70.00
June	.	.	770	100.00	83.00	70.00
July	.	.	770	100.00	83.00	70.00

Source : Weekly Report from M/s George Uhe, U.S.A.

The per-capita consumption of sandalwood oil is estimated to be about 0.00005 gms on the basis of world's population, while for India it is estimated to be about 0.05gms. The prices of sandalwood oil were reasonable to some extent till 1960. During the period 1961 to 1973, the prices remained to be about 20 to 35 US dollars per kg. But in 1974, the price of Sandalwood oil shot up to U.S. dollars 150 per kg. It is stated that this price rise in the year 1974 was because of rumours that sandalwood in the Mysore tract was going down. For this reason a few important traders tried to corner the produce. This was a blessing in disguise and the Indian produce got a handsome price in the world market. However, the Mysore Government was able to manage in establishing supply by despatching sufficient quantity of sandalwood oil in the world markets. By this time, the producers from other countries had also come up in the world markets. Importing countries, therefore, tried to explore other sources to meet their demand. This caused a slump in the prices and we find that after 1975, the prices slashed to about 65 US dollars per kg. However, during 1977-78 the prices stepped up and the sandalwood oil was sold at

the rate of 100 to 135 US dollars per kg. Thereafter again the prices started declining slowly. In spite of all this, Indian produce always received higher prices than the produce of other countries. Rates of Mysore Government sandalwood oil in export markets from time to time i.e. from pre-war to 1-5-1978 are given in Annexure V.

TABLE 5.2

Annual average prices of oil of Sandalwood at different markets

(In Rs/Kg.)

Year	MARKETS						
	Kup-pam	Kannauj	Chittoor	Calcutta	Kanpur	Cochi	
1960-61	185	183	..	..	..	..
1961-62	217	217	..	..	..	..
1962-63	180	180	..	..	..	..
1963-64	147	153	..	..	..	..
1964-65	158	165	..	..	..	..
1965-66	160	162	..	..	..	..
1966-67	227	235	..	..	..	..
1967-68	265	273	..	..	..	..
1968-69	271	275	..	..	..	..
1969-70	260	265	..	..	..	..
1970-71	262	270	223	268	N.A.	N.A.	
1971-72	271	273	223	289	N.A.	N.A.	
1972-73	272	277	221	285	N.A.	N.A.	
1973-74	518	530	360	425	N.A.	N.A.	
1974-75	1127	1130	800	928	N.A.	1069	
1975-76	559	575	505	764	N.A.	526	
1976-77	920	925	1000	796	850	881	
1977-78	1217	1225	950	1119	1129	1151	
1978-79	976	980	850	1215	913	941	
1979-80	850	840	825	960	800	827	
1980-81	738	775	945	1028	705	715	

5.2 Wholesale prices in India

The wholesale prices of sandalwood oil in India are governed, apart from other considerations, by the prices prevalent in foreign markets and the demand for the oil within the country. It is not a very speculative commodity, although there is some forward trading activity in this oil also. The prices generally register a change after the July and December auctions of sandalwood in Tamil Nadu State. The world prices of Sandalwood oil are also reflected in these auction prices to some extent. There

are seven principal markets for sandalwood oil viz. Mysore, Kuppam, Kannauj, Kanpur, Bombay, Cochin and Calcutta. Out of these seven markets Mysore is the most important centre which handles about 50 to 70 per cent of the total produce of India. The prices differ from market to market and also sometimes from one factory to the other but not widely.

Annual average wholesale prices per Kg. of oil of sandalwood at Kuppam, Kannauj, Chittoor, Calcutta, Kanpur and Cochin markets are given in Table No. 5.2.

From the above table, it will be observed that from 1960-61 to 1971-72, the prices in Kuppam and Kannauj were more or less the same. In most of the cases, there was hardly a difference of 5 to 10 rupees. The range of variation in prices was Rs. 12 to Rs. 37. However, at Chittoor, the price difference appeared to be significant. The reason for the low prices may be attributed to the sale of sandalwood in the nearby markets but during 1975-76, the variations in prices reduced considerably. During 1976-77 a vast difference was observed when the prices witnessed the highest at Chittoor than at any other centre. But, thereafter a subdued trend was seen till 1979-80. In 1980-81, the Chittoor prices were higher than the prices prevailing at other centres except Calcutta. The variation in the average wholesale prices was between Rs. 20 to 25 respectively. Calcutta showed a significant variation because of being at a far off distance from the producing zone and also being very few consuming units there. The inflow of sandalwood oil being very low, the prices at Calcutta prevailed higher due to other overhead charges.

At Kuppam, distillers sell sandalwood oil in bulk (50 to 100 kgs) to wholesalers, dealers at the wholesale rates. These wholesalers sell the oil to buyers like Handicrafts Emporium etc. as per their required packing at a higher price. The small consumers like Handicrafts Emporium request the wholesalers to supply sandalwood oil in 25 gms, 50 gms or 100 gms, packings. The prices of oil in such packings are usually 50 to 100 rupees higher per kilogram. Thus high cost is attributed by the wholesalers to the cost of containers/packings, labour charges and loss due to packings etc.

5.3 Seasonal variations in prices

There is nothing like seasonal variations in the prices and production of oil of sandalwood. The oil is produced throughout the year in Mysore. Private factories also generally obtain their stock of wood from different auctions for the whole year in

TABLE 5.3

Variation in wholesale prices during 1979-80 and 1980-81 at different markets

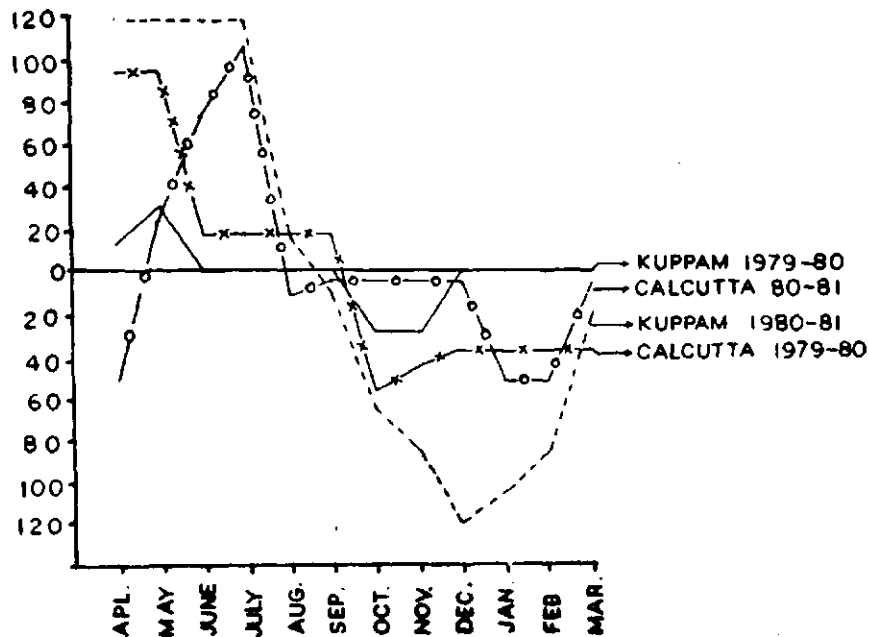
<i>Kuppam/Salem Market</i>					<i>Calcutta Market</i>				
Month of the year	Year 1979-80 Price/Kg (Rs)	% variation from the mean	Year 1980-81 Price/Kg (Rs.)	% variation from the mean	Month of the year	Year 1979-80 Price/Kg (Rs)	% variation from the mean	Year 1980-81 price/kg (Rs)	% variation from the mean
1	2	3	4	5	6	7	8	9	10
April . . .	860	+1.18	825	+11.79	April . . .	1050	+9.37	975	-5.16
May . . .	875	+2.94	825	+11.79	May . . .	1050	+9.37	1050	+2.14
June . . .	850	+0.00	825	+11.79	June . . .	975	+1.56	1103	+7.30
July . . .	850	+0.00	825	+11.79	July . . .	975	+1.56	1135	+10.41
August . . .	850	+0.00	750	+1.62	August . . .	975	+1.56	1000	-2.72
Sept. . . .	850	+0.00	730	-1.08	Sept. . . .	975	+1.56	1025	-0.29
October . . .	825	-2.94	690	-6.50	October . . .	905	-5.73	1025	-0.29
Nov.	825	-2.94	675	-8.54	Nov.	915	-4.69	1025	-0.29
Dec.	850	+0.00	650	-11.92	December . . .	925	-3.65	1025	-0.29
January . . .	850	+0.00	660	-10.57	January . . .	925	-3.65	975	-5.16
February . . .	850	+0.00	675	-8.54	Feb.	925	-3.65	975	-5.16
March	850	+0.00	725	-1.76	March	925	-3.65	1025	-0.29
Yearly Av.	850	Yearly av.	738		Yearly av.	960	Yearly av.	1028	

TABLE 5.3—Contd.

Variation in wholesale prices during 1979-80 and 1980-81 at different markets

Cochin Market					Kanpur Market				
Month of the year	Year 1979-80 Price/Kg (Rs)	% variation from the mean	Year 1980-81 Price/Kg (Rs)	% variation from the mean	Month of the year	Year 1979-80 Price/Kg (Rs)	% variation from the mean	Year 1980-81 price/Kg (Rs)	% variation from the mean
1	2	3	4	5	6	7	8	9	10
April . . .	825	-0.24	813	+13.71	April . . .	725	-9.37	800	+23.48
May . . .	825	-0.24	813	+13.71	May . . .	750	-6.25	725	+2.84
June . . .	838	+1.33	800	+11.89	June . . .	800	+0.00	750	+6.38
July . . .	868	+4.96	800	+11.89	July . . .	825	+3.12	760	+7.80
Aug. . . .	838	+1.33	713	-0.28	August . .	650	-18.75	750	+6.38
Sept. . . .	838	+1.33	725	+1.40	Sept. . . .	850	+6.25	725	+2.84
October . .	813	-1.69	700	-2.10	October . .	850	+6.25	725	+2.84
Nov. . . .	813	-1.69	638	-10.77	Nov. . . .	850	+6.25	700	-0.71
Dec. . . .	813	-1.69	638	-10.77	December .	825	+3.12	650	-7.80
January . .	825	-0.24	638	-10.77	Jan. . . .	825	+3.12	625	-11.35
Feb. . . .	813	-1.69	650	-9.09	Feb. . . .	825	+3.12	625	-11.35
March . . .	810	-2.06	650	-9.09	March . . .	825	+3.12	625	-11.35
Yearly Av.	827	Yearly av.	715		Yearly av.	800		Yearly av.	705

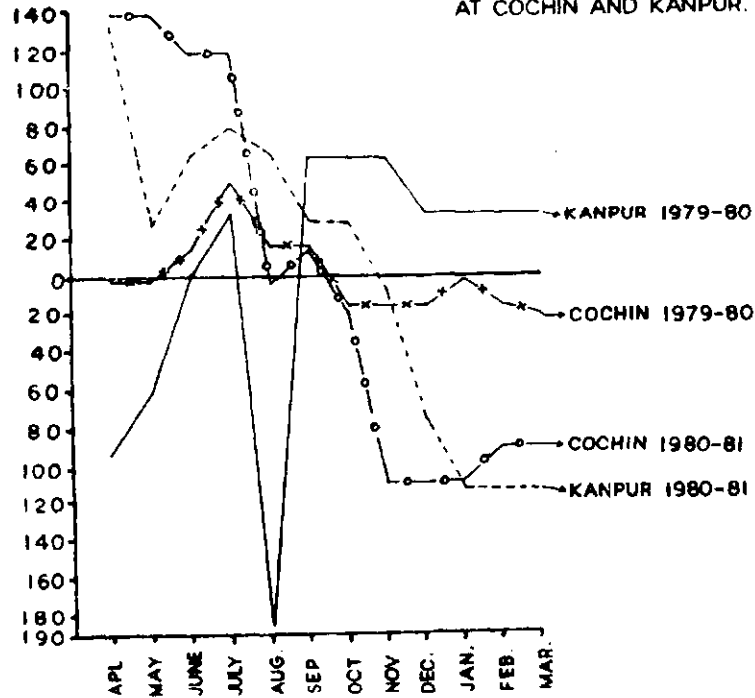
PERCENTAGE VARIATION IN WHOLESALE PRICES. DURING 1979-80 AND 1980-81 AT KUPPAM AND CALCUTTA.



GRAPH No. 5

**PERCENTAGE VARIATION IN SANDAL OIL
WHOLESALE PRICES.**

DURING 1979-80 AND 1980-81,
AT COCHIN AND KANPUR.



order to run their factories. They get their stock in July and December, mainly from the auctions held in Tamil Nadu State. After such auctions, the prices of oil either rise or fall and soon become more or less steady. However, the prices in Karnataka did not fluctuate much. Annexure VI gives the monthly average wholesale prices of sandalwood oil at different markets during the various years. Table No. 5.3 presents the percentage variation in wholesale prices for the years 1979-80 and 1980-81 at four centres namely Kuppam, Calcutta, Cochin and Kannauj markets. The graph Nos. 4 and 5 illustrate these variations. The graphs also indicate that the prices during the period June to August tend to be nearer to the average prices. The fluctuations are observed to be wider during the period from November to February but no set pattern is however, discernible.

5.4 Retail Prices

Only a small quantity of sandalwood oil is sold in the market in retail. A few dealers (brokers) or people like Handicrafts Emporium, *Agarbatti* manufacturers and some other traders in different parts of the country purchase small packings of sandalwood oil to cater to their needs. Generally, this small quantity at far off places is stored by provisional stores or by grocers, who in turn supply it to customers to meet their religious and other needs. Since the quantity involved is very small and the consumer is not very much sensitive about its high price, they feel satisfied to get the produce packed in small quantity at the time of their need. No reputed brands etc. play a major role in such retail selling. The retail prices are stated to vary from place to place. Very small quantity of sandalwood oil is used in Sikkim State wherein retail shops, it is sold at the rate of Rs. 30 per bottle containing about 7 ml. of oil. It is stated that in Jammu & Kashmir, it is sold at the rate of Rs. 1800 per kg. Similarly in Bihar although wholesale price of sandalwood oil was Rs. 900 per kg. but in retail it was sold at about Rs. 3,000 per kilogram. In Delhi also the retail price was stated to be about Rs. 2000 per kg.

5.5 Slump in prices and gluts

The natural sandalwood oil did undergo both the experiences i.e. short supply and the worst slump in the market during the years 1978 to 1981. The situation has not yet improved much inspite of fall in prices. Government intervened to minimise the risk by fixing minimum support price for its export. The main reason for this slump was stated to be lack of demand for sandalwood oil in the market during the years 1975-76. The

other reasons were that in the year 1977, the Indonesian sandalwood oil entered in huge quantities in the international markets which adversely affected Indian monopoly in the trade and caused a steep fall in demand for Indian sandalwood oil.

In the year 1980, the demand for East Indian sandalwood oil came down considerably, resulting in accumulation of sandalwood oil stocks in the country. Ban on export of sandalwood also created slump in the wood market and consequently the oil prices touched the low levels which still continues in the country.

5.6 Market Intelligence

Previously forward trading for sandalwood oil was for about six months or so. This has now reduced to one month only. The traders generally carry out their business on the basis of their speculation and restricting themselves for one month forward trading. The salient features of the sources of information for sandalwood oil are given below:—

- (1) The weekly bulletins issued by U.K. and the Chemical Marketing Exporters issued from New York.
- (2) The people who participate in auctions in Tamil Nadu, Andhra Pradesh and Kerala.
- (3) The quality of various classes of sandalwood purchased by different parties at the time of auctions becomes known at the site itself.
- (4) The probable quantity of sandalwood oil produced by different distillers could be calculated on the basis of each class of wood purchased by them and the general yield of oil of definite percentage *i.e.* 55 per cent in roots and 2.5 per cent in case of chips of basola etc. gives the estimate of production of sandalwood oil by distillers.
- (5) The quantity of sandalwood oil produced by the illicit distillers of Kerala was always a secret. The information usually becomes available to trade only when the Kerala distiller approach the exporters with his oil.
- (6) The foreign buyers have their own intelligence units to collect the information of production of essential oils and its prices etc. in different countries by contacting different people and agencies. In India, the sources of information are—
 - (i) Information published by various Departments like Commerce, Forest and Trade etc.

- (ii) Market arrivals reported by the Forest Departments and Private agencies and prices at various estates.
 - (iii) Essential Oils Intelligence Bulletin issued by the Agricultural Marketing Adviser to the Govt. of India from Essential Oil grading Scheme, Cochin.
- (7) Auction stocks are notified by Tamilnadu Govt. through Public notices and also to prospective bidders. The prices and auction notices are also published in important newspapers.

There is nothing like market arrivals in respect of sandalwood oil. In the marketing of this commodity only the distillers and exporters are involved. The stock will be released by the distillers only against specific orders.

The prices are generally known by the traders either through radio or telephone contacts or through newspapers. The prices in the foreign markets are also made known by the traders through overseas communications.

5.7 Cost of Production of Sandalwood oil

The cost of production of oil varies from factory to factory depending upon the efficiency of the plant, the oil content of the wood and the cost of fuel and water. Fuel is the main item adding to the cost of production. This varies from 7 to 20 per cent of the total cost of production of sandalwood oil depending upon the availability of fuel at the distillation centres. Sandalwood claims 65 to 75 per cent of the sale price of Sandalwood oil.

For calculating cost of production of oil, an example of an average size factory handling 100 tonnes of sandalwood per annum has been taken here for three different centres viz. Kuppam, Kanpur and Kerala Unit. A factory processing 100 tonnes of wood may require 5 stills of a half tonne capacity each 4 stills working regularly and the 5th unit lying as a standby. On an average, there are 300 working days in a year and for complete distillation of one charge, it takes about 6 days. Thus an idea of cost of production can be had from the examples given in Table No. 5.4.

From these examples, it will be seen that the quintessence cost for isolation of oil varies from Rs. 175 to Rs. 254 per kilo-

TABLE 5.4

Examples to illustrate cost of production of Sandalwood Oil by an optimum size manufacturing units at different places

KUPPAM		KANPUR		KERALA			
A. Capital Investments		A. 1. Building		5,00,000	A. 1. Building		
1. Building		2. Boiler (1)		2,00,000	2. Boiler		
2. Boiler		3. Stills with accessories 6 sets		3,00,000	3. Stills with accessories		
3. Stills with accessories		4. Disintegrator with the motor		10,000	4. Condensor with accessories 5,00,000		
4. Condenser with accessories & receives 5,00,000		5. 4 Pumping sets @ 6,000/- each		24,000			
				10,34,000			
	@ Rs. p.m.	@ Rs. p.a.		@ Rs. p.m.	@ Rs. p.a.	@ Rs. p.m.	@ Rs. p.a.
B(a) 1. Directors	3	—	5,400	B(a)		B(a) 1. 3	1,200 43,200
2. Manager	1	300	3,600	2. 1	500	6,000	2. 1 400 4,800
3. Typist	1	250	3,000	3. 1	300	3,600	3. 1 300 3,600
4. Cashier/Accountant	1	300	3,600	4. —			4. 1 350 4,200
5. Clerks	2	250	6,000	5. —			5. 2 300 7,200
6. Office Boy	1	125	1,500	6. —			6. 1 150 1,800

TABLE No. 5.4—Contd.

KUPPAM			KANPUR			KERALA				
	@ Rs. P.M.	Rs. P.A.		@ Rs. P.M.	Rs. P.A.		@ Rs. P.M.			
7. Boiler Attendant	3 200	7,200	7.	4	300	14,400	7.	2	300	7,200
8. Labourers for cutting, chipping etc. @ Rs. 4 per day (7 labourers) for 300 days		8,400	8.	5	300	18,000	8.	8	@ Rs.9/- a day for 300 days	21,600
9. T.A. for Directors & Staff		12,000	9.	—			9.	—		10,000
10. Repairing charges for new machinery		15,000	10.	—			10.	—		7,000
11. Stationery		2,000	11.	—			11.	—		
Total	Rs.	1,16,300								
12. Mistry	—		12.	1	400	4,800	12.	—		
13. Coalman	—		13.	3	200	7,200	13.	—		
14. Sundries	—		14.	—			14.	—		1,000
15. Others	—		15.	4	250	12,000	15.	—		
			Total		Rs.	66,000	Total	Rs.	1,11,600	

P.M. = Per Month

P.A. = Per Annum

KUPPAM		KANPUR		KERALA	
<i>B(b) Interest on cost of Sandalwood purchased in July 80 auction</i>		<i>B(b) Duties cost of Sandalwood purchased during July|Dec. auctions.</i>		<i>B(b) Sandalwood purchased in Govt. auction</i>	
(i) Cost of 1 tonne of Sandalwood	23,300	(i) Cost of 1 tonne of wood	20,500	(i) Cost of 1 tonne of wood	23,000
(ii) S.T. @ 5%	1,165	(ii) S.T. @ 10 %	2,050	(ii) S.T. @ 4.4%	1,012
(iii) Expenses for Transportation, weighing, loading & unloading	200	(iii) Expenses for taking delivery period	200	(iii) Expenses for transportation, weighing, loading and unloading etc.	200
(iv) Total cost of wood per tonne	24,665	(iv) Total cost M. tonne	22,750	(iv) Total cost per 1 tonne	24,212
(v) Hence cost for 100 tonne	24,66,500	(v) Hence cost per 100 M. tonne	22,75,000	(v) Cost of 1 tonne	24,21,200
(vi) Interest @ 16 %	<u>3,94,640</u>	(vi) Interest @ 18%	<u>4,09,500</u>	(vi) Interest @ 18%	<u>4,35,816</u>
<i>B (c) Depreciation @ 6% on capital investment.</i>	30,000	<i>B (c) Depreciation @ 6% on capital investment</i>	62,040	<i>B (c) Depreciation @ 5% on capital investment</i>	25,000

KUPPAM		KANPUR		KERALA				
<i>B d)</i>	Fuel for 500 tonne of coal @ 500 per tonne for distilling 100 tonne of Sandalwood	2,50,000	<i>B (d)</i>	Fuel 1300 tonne of coal @ 500 per tonne	6,50,000	<i>B (d)</i>	Fuel for 500 M. tonne, 2,50,000 of coal @ Rs. 500 per M. tonne for distilling 100 M. tonne S.W.	
<i>B e)</i>	Light, Water & other contingencies.	20,000	<i>B (e)</i>	Light, Water cartage & other contingencies per year	30,000	<i>B (e)</i>	Light, Water & other contingencies.	20,000
	Total annual expenditure	8,10,940		Total expenditure	1217540		Total annual expenditure	8,42,416
	cost of wood	24,66,500		Cost of wood	2275000		cost of wood	24,21,200
	Total	32,77,440		Total	3492540		Total	32,63,615
<i>C</i>	Yield of oil from 100 M. tonnes of S. wood.	4,650Kg.	<i>C</i>		4,800 Kg	<i>C</i>	Yield of oil from 100 M. tonne of S. wood	4,600 Kg.
<i>D</i>	Cost of production of 1 Kg of oil	(Approx.) Rs. 705/-	<i>D</i>		Rs. 728/- (approx.)	<i>D</i>	Cost of production of 1 Kg of Sandal oil	Rs. 709/ (approx.)
<i>E</i>	Distilling cost Rs. (705—530) (Production Cost—Wood cost)	Rs. 175-00	<i>E</i>		Rs. 728—474 Rs. 254			Rs. 709—526 Rs. 183

P.M. = Per month P.A. = Per Annum

gram depending upon the efficiency of its working unit and fixed investment per kilogram of sandalwood oil. The production cost varies from Rs. 705 to Rs. 728. It is of course quite obvious that bigger the capacity of the factory, the lesser will be the cost of production per unit of oil.

5.8 Cost of the oil in relation to average price of sandalwood

The cost of the oil will normally depend upon the auction price of wood and conversely the price of oil in international markets will affect the auction rates for sandalwood. The average price of all classes of sandalwood obtained per tonne in Tamilnadu by two different parties of Kuppam and Kanpur in various years have been compiled alongwith their other details like sales tax, handling and processing charges and yield per metric tonne for the year, 1975-76 to 1980-81 as given in Table No. 5.5. From this table it may be observed that the prices at Kuppam and Kanpur varied over years considerably. In general, the prices at Kuppam were considerably lower than the prices at Kanpur. From the figures, it is difficult to understand the economics of private factories in North and South India. Sometimes, the prices at Kanpur are nearabout the same as has been observed at Kuppam and sometimes there is a variation from 300 to 400 rupees. A marginal variation can be attributed to handling and transportation charges but in general the prices given by Kanpur traders appear to be a little on the higher side. It is also stated that the North Indian Traders sometimes purchase the sandalwood from the forest of Madhya Pradesh, Uttar Pradesh and from the Pattawala in Tamilnadu State at a bit cheaper rate than the auction prices in Tamilnadu. It is also stated that sometimes the smuggled wood also reaches the North Indian distillers and they succeed to get it at a cheaper rate than the prevailing auction prices. None of the traders could be pursued to disclose this mystery to any one else. Exact information and data on production of oil or wood are also not furnished by the traders due to fear of income tax, excise duty and sales tax etc.

The production cost from Mysore Government Sandalwood Factory (K.S.D.L.) could not be obtained in the desired format. However, an idea for the cost of production can be taken from the data presented in Annexure VII for few years. This also gives the information on average expenditure per kilogram incurred under different heads for the production of one kilogram of sandalwood oil.

TABLE 5.5

Average cost of production per kg. of Sandalwood Oil

Market	Year	Average bidding price of sandalwood per tonne. (Rs.)	Sales Tax (Rs.)		Handling & processing charges (Rs.)	Total cost of processing per tonne of sandalwood (Rs.)	Yield of sandalwood oil (Kg.)	Cost of sandalwood oil per kg. (Rs.)
Salem/Tiruvanamalai/Kuppam	1975-76	20663	1033	@5%	1575	23271	46.5	500
	1976-77	38847	1942	"	1625	42414	46.5	912
	1977-78	47400	2370	"	1650	51420	46.5	1105
	1978-79	38500	1925	"	1700	42125	46.5	905
	1979-80	31000	1550	"	1725	34125	46.5	737
	1980-81	18340	917	"	1750	21007	46.5	452
Kanpur	1975-76	24500	1348	@5.5%	4000	29848	48.0	622
	1976-77	55000	3025	"	4500	62525	48	1303
	1977-78	50000	2750	"	5000	57750	48	1203
	1978-79	41000	2255	"	5500	48755	48	1016
	1979-80	28000	1540	"	6000	35540	48	740
	1980-81	20500	1128	"	6500	28128	48	586

6. ASSEMBLING, STORAGE AND DISTRIBUTION OF SANDALWOOD OIL

6.1 Assembling

Sandalwood oil is the product dealt by well-established distilleries and the sale and purchase is generally done by the firms or their agents. The factories are fairly large units and after distilling the oil they market it directly. In Karnataka, sandalwood oil trade is a State's monopoly. M/s Mysore Sales International Ltd., Bangalore act as the global sole selling agents for the factory.

The sole selling agents on booking the demands, indents in from the factories to effect supplies which is complied with. The factories collect ex-factory selling price while the sole selling agents sell the product for an end-selling price. The difference between the two, constitutes the margin for the overhead expenses incurred by the agents including the profit percentage. The goods are packed by the factory units in the standard packings and delivered to the agents at the factory premises. The agent is allowed a period of 30 days to remit the value of invoice preferred on them for the quantity of oil that is to be delivered to the buyer through the agents. In case of non-remittance of invoice value by the agents within 30 days from the date of invoice, an interest at the rate of 14.5 per cent for the delayed period is claimed and collected. In Karnataka, the sandalwood oil factories, are owned by the Government. The finance is being managed through the nationalised banks and industrial Development Corporation. The sandalwood oil meant for export is transported by air only through the Government agency i.e. M/s Mysore Sales International Ltd., Bangalore. For encouraging export, the sandalwood oil is exempted from sales-tax and excise duty. The private distillers collect orders and supply sandalwood oil from their factory themselves.

6.2 Distribution

From U.S.A., the buyers contact the seller through a broker and open a letter of credit with the seller in India. The broker in this case acts merely as a middle man, for his brokerage. Contracts for continental countries are also made in a similar way through continental brokers. The brokers in London, who handle about 50 per cent of the contracts for Europe, however, act differently. They get the oil in their name and open the letter of credit with the seller in India also in their own names. They

are members of the General Produce Brokers' Association in London. Practically all established exporters get the full invoice value of the consignments as soon as the export documents are presented. In case of new entrants, however, 85 to 95 per cent of the value is paid on the presentation of documents while the balance is paid on the inspection and Weighment of the goods at destination depending upon the reputation of the exporters.

The important agencies involved in the wholesale distribution of sandalwood oils are listed below :—

- (1) M/s China Exports, New Delhi.
- (2) M/s Mysore Sales International Ltd., Bangalore.
- (3) M/s L. A. Champon, New Jersey (Importers), Australia.
- (4) M/s George Uhe Co. Inc. Brokers, 76 Ninth Avenue, New York N.Y. 10011.
- (5) M/s R. Sarant & Co. Ltd., 147, London Road, Kingston Upon Tames, Surrey, U.K. (Chief sales Agent of Indian Company Limited Products).
- (6) M/s Polaroma Manufacturing Co. Inc. 22 Ericsson place New York.
- (7) M/s Biddle Sawyer Corp., U.S.A.
- (8) M/s F. D. Copeland & sons Ltd. 115, Trays' Inn Road London We ix 8 UK.
- (9) M/s Dennis & Co. 9 Ice house street, Hong Kong.
- (10) M/s John D. Walsh Co. Inc., 32 Broadway, New York.

In States other than Karnataka, the sandalwood oil trade is transacted/carried out by the distillers themselves except the illicit distillers. The illicit distillers sell their produce to the exporters by direct negotiations. No other agencies are involved in this business.

The European Economic Community primarily imports essential oils as raw materials from the following international companies :—

- (1) Bush Boak Allen. (Albright and Wilson Subsidiary).
- (2) Proprietary Perfumes and Food Industries (Unilever).
- (3) International Flavour and Fragrances.

(4) Givandan (Haffmann La Roche).

(5) PFW (Hercules).

(6) Noarden and Firemanich.

The prominent agents for import of essential oils to Japan are: ---

(1) Meiwa Trading Company.

(2) Soda Aromatic Company.

6.3 Trade Practices

The American buyers keep enough stock for about two or three months and send their orders in advance steadily for their requirements. The Indian distillers keep sufficient stock to meet the foreign buyers' demands. Sandalwood oil is available from these distillers at a cheaper rate as they are exempted from excise-duty because of their turn-over being less than Rs. 15 lakhs. Some traders also readily go in for graded oil for a small margin and conclude an export order by taking advantage of the market price. Some dealers in essential oils in Bombay also pass on their letter of credit for 3 to 4 per cent margin to distillers. U.S.A. buyers and agents keep a constant watch on the trends in the price fluctuations as well as the supply of sandalwood oil in the market and in the producing countries so as to have a proper share of profit towards their investment.

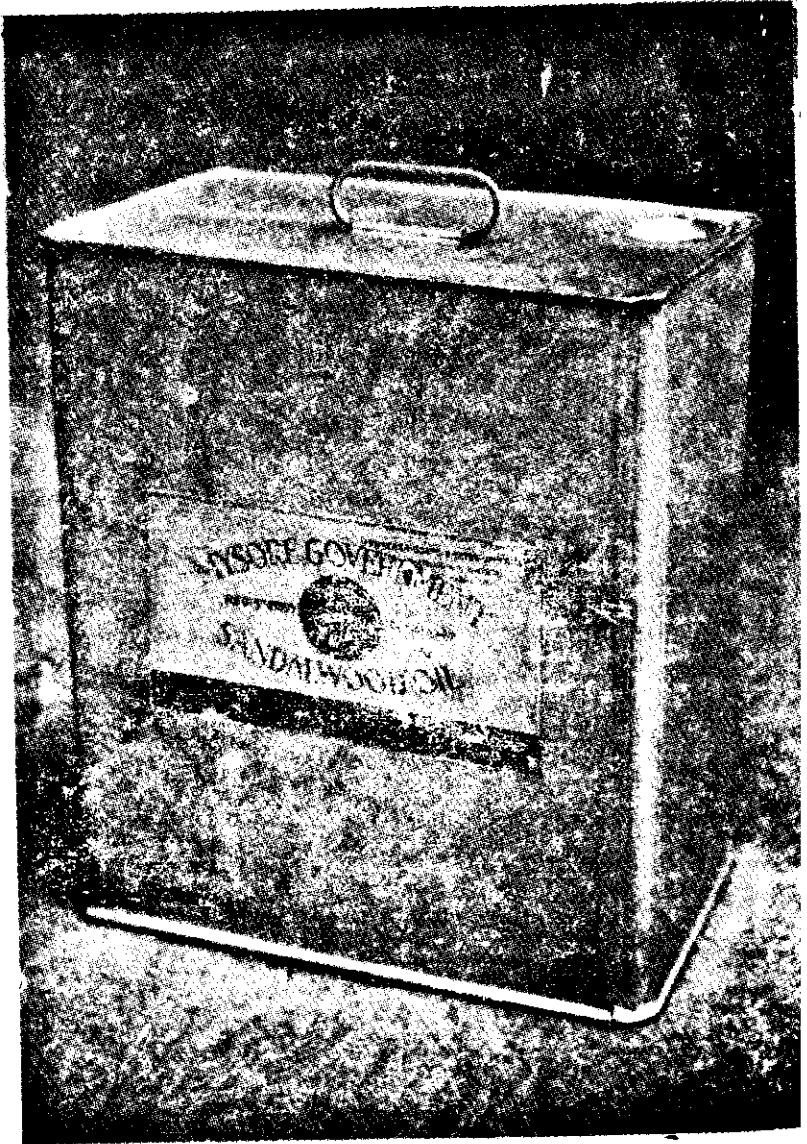
In India, the consignments are booked through banks on receipt of orders from the commission agents and a copy of the invoice is sent to the broker who ensures that the buyer would honour the contract. Usually, when oil is graded and packed in 5 kg. tins, it is sent through banks to buyer for delivery at the destination.

6.4 Storage and packaging.

6.4.1 Storage

The sandalwood oil is usually stored in the premises of the factory. For such storage, tanks made of copper with inner side tinned are used. Their capacity ranges from 100 to 500 kgs. Recently some aluminium tankers have been introduced due to scarcity of copper. Both types of storage tanks are considered satisfactory in the trade as there is no adverse effect on the quality of oil stored therein. All the factories have got sufficient storage capacity for their produce. Hence there is no problem

ILLUSTRATION NO. 6 (a)

**Sandalwood Oil**



Packing of Sandalwood oil in small containers

in this regard. Since the cost of the storage tanks is insignificant as compared to other immovable properties of industry, these expenses have not been calculated separately for storage of oil to find out the storage cost.

6.4.2 Packing and containers

The sandalwood oil is packed in various types of containers made of galvanised iron, spun aluminium, tin, glass etc. For marketing sandalwood oil within the country, small packings below 500 grams are popular (See Figs 6(a) & 6(b)). The cost of containers varies slightly from place to place. The cost, type and capacity of containers in use for packing of sandalwood oil are reported here in Table 6.1.

TABLE 6.1

Cost, type and capacity of containers in use for packing of Sandalwood Oil

Sl. No.	Type of containers	Capacity	Made of	Cost (Per container)
1.	Drums	25 Kgs.	Tinned iron sheets.	Rs. 50 to 60
2.	Tin	10 Kgs.	Do.	Rs. 12.90
3.	Tin	5 Kgs.	Do.	Rs. 5 to 7
4.	Tin	5 Kgs.	Galvanised iron sheet.	Rs. 15 to 20
5.	Tin	4 Kgs.	Tinned iron	Rs. 6.30
6.	Tin	2 Kgs.	Do.	Rs. 5.00
7.	Bottle	1 Kg.	Aluminium	Rs. 5 to 7
8.	Do.	500 gms.	Do.	Rs. 4.50 to 5.00
9.	Do.	100 gms.	Do.	Rs. 3.50
10.	Do.	50 gms.	Do.	Rs. 2.50
11.	Do.	50 gms.	Glass	25 to 50 paise
12.	Do.	25 gms.	Aluminium	Rs. 1.75 to 2.00
13.	Do.	25 gms.	Glass	25 paise
14.	Do.	10 gms.	Aluminium	62 paise
15.	Do.	10 gms.	Glass	20 paise

In the trade, aluminium packings are preferred. The oil stored therein does not get deteriorated even on storing for a longer period. However, the plastic containers, though cheaper and light in weight, are not preferred due to its risk of damage

in transit. The oil meant for export is generally packed in 5 Kgs. Containers made of tinned sheets due to economical considerations. The cost of a container of 5 Kgs. is Rs. 5 to Rs. 7 in the market. After filling the containers, 3 to 4 containers are packed in wooden cases. In case of air freight, the tins are transported as such and are not packed in wooden cases. In some cases, the foreign buyers demand for 500 gms./250 gms. packings. In such cases, the spun aluminium containers are usually used. The small packings are further packed in suitable light wooden cases. The cost of such empty containers has been shown in Table No. 6.1. The details of cost of packing and transportation to foreign countries for 100 Kilogrammes of sandalwood oil are presented below in Table No. 6.2.

TABLE 6.2

Cost of packing and forwarding for 100 kgs. of Sandalwood Oil

Items	Size-I	Size-II
1. Size of container	25 Kgs (Drum)	5 Kg. Tin
2. Weight of empty container	3.5 Kgs.	0.520 kg.
3. Cost of container	Rs. 60.00	Rs. 7.00
4. No. of containers transported (100 kgs)	4 Nos.	20 Nos.
5. Total Cost	Rs. 240.00	Rs. 140.00
6. Total weight transported	100 ÷ 14 = 114 Kgs.	110.5 Kg.
7. Freight charges @ Rs. 28 per kg.	Rs. 3,192.00	Rs. 3,094.00

N.B.—Freight charges taken as furnished at the time of interview for as specific destination.

Difference of cost in both the packings is Rs. 98 (3192—3094) for 100 Kgs. of sandalwood oil.

Thus there is a significant difference in cost for transporting 100 Kgs. of oil in 25 Kgs. drums and in 5 Kgs. tins. Therefore, traders usually prefer 5 kgs. tins for packing consignments. This reduces the labour charges and other costs that might be incurred in its repacking. The packed sandalwood oil in containers carry details of sandalwood oil such as trade mark, quantity of oil in the containers, Agmark lable etc. which are invariably displayed on the container. The Karnataka Sandalwood Oil is well-known to the trade for its quality and desired fragrance. Therefore, it always gets high premium on the very display of details on these containers.

6.4.3 *Effect of metal on the quality of the product*

During storage the sandalwood oil undergoes various changes. The physical characteristics change fast than the chemical, the specific gravity increases, solubility decreases indirectly and refractive index also increases. A slight variation in lowering of santalol content has been reported. However this was not perceptible in short durations. The packing in copper containers without tinned lining causes deep colourisation of sandalwood oil.

6.4.4 *Cost of packaging*

According to an estimate, the package cost varies from 1 to 2 per cent of the cost of sandalwood oil depending upon containers used for the packing. The smaller the container, the higher is the cost of packing and transportation. The weight of the containers, material made from and the price of containers are the prime factors.

6.4.5 *Market charges*

The prevailing market charges at Bombay are central excise duty at the rate of 8 per cent and central sales tax of the rules of 4 per cent. At Ahmedabad octroi is being paid at the rate of 5 per cent when the consignments are transported to the premises. In most of the States, dealers have their sales tax number for the States as well as for Centre separately. They make the payment for it as per the rules. The traders issue the cheques/drafts as per the rates and amount given in the confirmatory letter.

6.4.6 *Cost for export consignments*

The sandalwood oil is exported to the foreign countries by air. The quotations are generally inclusive of F.O.B. cost. Some quotations are given on C.I.F. basis *i.e.* cost, insurance and air freight. The insurance is generally arranged by the buyer.

The cost of packing including the cost of containers, has been estimated at 2.50 to 3.50 rupees per kilogram. It works out to about 0.003 per cent of its price. The average freight to consuming centres per kilogram, may vary from place to place. The main costs involved on F.O.B. export consignments of oil of sandalwood exported to different destinations are presented in the following example.

EXAMPLE

I. Export costs on F.O.B. basis to U.S.A. for 200 kgs. of Sandalwood Oil despatched from Salem/Kuppam to U.S.A. by Air in June, 1981.

	Rs.
(i) Distillers' cost price for 200 kgs. of oil at the rate of Rs. 650/- per kg.	1,30,000.00
(ii) Sales tax— Nil	Nil
iii) Cost of tins (containers) each 5 kgs.	
(a) Cost of each tin Rs. 16.00	
(b) Total No. of tins required—40	
(c) Total cost Rs. 16×40	640.00
(iv) Labour charges for 200 kgs. of oil (Includes, filling, loading, weightment charges, soldering charges)	475.00
(v) Wastage during filling etc. 0.5 kg. @ Rs. 650 per kg.	325.00
vi) Transportation charges for 200 kgs. of oil by taxi or by train	
(a) Cartage from factory to local Railway Station	80.00
(b) Railway station to Bangalore Rly. Station	200.00
(c) Loading and unloading charges at Kuppam/ Salem and Bangalore Rly. Station	50.00
(d) Bangalore Railway Station to Airport (by tempo)	175.00
(e) Director's ticket and hotel stay charges	80.00
	585.00
	600.00*
*N.B.- Since taxi is quicker, time saving and safe, the cargo is usually moved by taxi.	
vii) Grading (AGMARK) charges for 200 kgs. of oil	200.00
viii) Clearing Agents commission	250.00
ix) Insurance charges 0.5 per cent on cost (i)	650.00
x) Foreign Agent/Brokers commission @ 2 per cent of cost (i)	2600.00
xi) Interest for a month on cost (i) at the rate 18 per cent per annum	1950.00
Total expenses for the export of 200 kgs. sandalwood oil	1,37,690.00
Total export cost of 1 kg. sandalwood oil	688.45
xii) Sale price of 1 kg. of oil	750.00
xiii) Margin of profit of exporter per kg.	61.55
xiv) Exporter's profit share in terms of percentage to the F.O.B. price.	8.91%

II. Export costs on C.I.F. basis

	Rs.
(i) Total expenses upto Airport for 200 kgs. of Sandalwood oil (including insurance)	1,37,690.00
(ii) Freight charges from Bangalore to U.S.A. for 200 kgs. of sandalwood oil	5000.00
(iii) Total export cost on C.I.F. basis for 200 kgs. of Sandalwood oil	1,42,690.00
(iv) Export cost of 1 kg. of Sandalwood oil on C.I.F. basis	713.45
(v) Sale price of Sandalwood oil in U.S.A market per kg. \$86.5 (N.B. 1\$ = 9.00 rupees at the time of sale of sandalwood oil in USA market).	778.50
(vi) Margin of profit on export of 1 kg. of Sandalwood oil on C.I.F. basis	65.05
(vii) Exporters profit share in terms of percentage to the C.I.F. price	8.36%

7. GRADING AND STANDARDISATION

7.1 Need for grading of sandalwood oil under Agmark

As already pointed out, India is the principal supplier of oil of sandalwood to the world market. Strict control over the quality of the oil exported and the high standard of production achieved by the former Mysore State have earned for India a reputation the world over. The success attained by the Mysore Government factories gave impetus to other sandalwood oil factories in the country. The number of such factories steadily increased. With the passage of time, however, the quality of the oil exported by some manufacturers started deteriorating and sometimes, it was not found to be upto the standard by foreign buyers. Attention of the Government of India was drawn to this deteriorating state of affairs. It was realised that the country could maintain the reputation of this highly priced oil of sandalwood in the face of competition in the world market from the "so called oils of sandalwood" only by keeping the foreign buyers satisfied about the purity and quality of the product exported from India. The Planning Commission in the First Five Year Plan had recommended compulsory grading for export of some essential oils. In pursuance of this policy, oil of lemongrass was already being graded on a compulsory basis under Agmark for export and had thereby established a reputation abroad. The scheme for compulsory quality control and pre-shipment inspection under Agmark was extended to cover exports of oil of sandalwood also and from 1-2-1957 the export of ungraded oil was banned from the country.

7.2 Framing of Agmark Specifications

The grade specifications prescribed under the Agricultural Produce (Grading and Marking) Act, 1937 are popularly known as "Agmark" specifications. The word "Ag" stands for "Agricultural" and "mark" for "marketing". Agmark specifications for oil of sandalwood have been prescribed under the Essential Oils Grading and Marking Rules, 1954 promulgated under the provisions of the Agricultural Produce (Grading and Marking) Act, 1937. These may be seen at appendix II.

The Indian Standards Institution in consultation with the trade; the Essential Oils Research Committee of the Council of Scientific and Industrial Research; the Directorate of Marketing and Inspection, Ministry of Food and Agriculture; and other

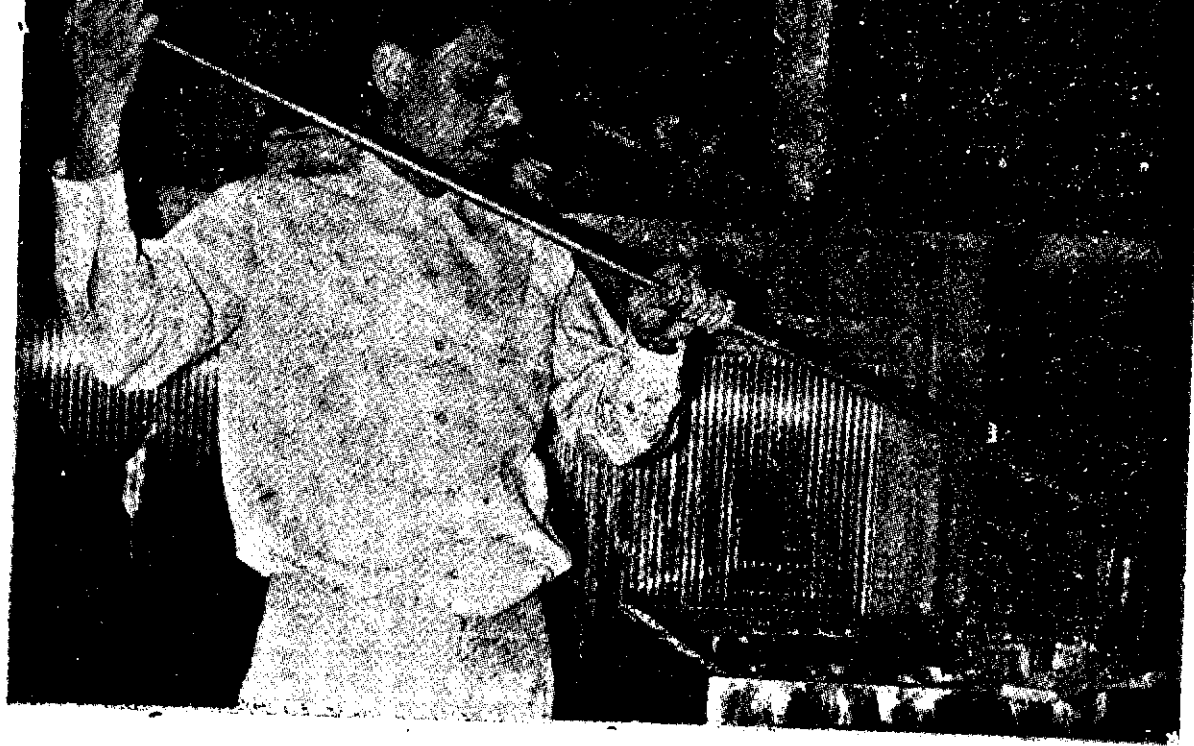
interests concerned, had drawn up standards for oil of sandalwood under IS : 327—1952. They had further standardised the methods of testing essential oils under IS : 326—1952. Agmark specifications were drawn up on the basis of IS:327—1952 and the IS methods of testing were also adopted. A meeting of the producers of oil of sandalwood in the country was convened at Bangalore in 1956 under the chairmanship of the Agricultural Marketing Adviser to the Government of India, to discuss in detail and finalise arrangements for the compulsory grading of the oil before export, under Agmark. The progressive elements in the trade welcomed the scheme and offered their whole hearted support. The Government of Mysore too in the larger interest of the nation agreed not only to fall in line but also to offer its fullest cooperation in this endeavour. By Notification No. SRO-3184 dated the 28th December 1956 issued by the Ministry of Finance under the provisions of Section 19 of the Sea Customs Act, 1878, the Government of India banned the export of the oil of sandalwood produced in India with effect from the 1st February 1957, unless such oil had been graded in accordance with the provisions of the Essential Oils Grading and Marking Rules, 1954 and was accompanied by a certificate of grading issued by a duly authorised person. The Essential Oils Grading Laboratory, Cochin, and the Central Control Laboratory (now Regional Agmark Laboratory), Kanpur of the Directorate of Marketing and Inspection, undertook to take up grading of sandalwood oil. Since Kuppam is an important centre for production of this oil, a sub-office was also set up there to look after the grading work in that area.

7.3 Modus operandi for grading

Details regarding the day-to-day working of the scheme are contained in the "Instructions for Grading of Lemongrass and Sandalwood Oils under Agmark" issued by the Agricultural Marketing Adviser to the Government of India. These have been drawn up and finalised in consultation with the trade and other interests. Some of the important features of the grading scheme are discussed below :

7.3.1 *Persons who may grade*

Any person or firm desirous of grading oil of sandalwood has to obtain a "Certificate of Authorisation" from the Agricultural Marketing Adviser to the Government of India. Requests for Certificate of Authorisation have to come through State/ Regional offices. Enquiries are made about the *bonafides* of the party applying for a Certificate of Authorisation, the premises where grading is proposed to be done are inspected, and the ability of the party



Sampling of Sandalwood Oil



A View of the testing laboratory



Analysis in progress

to abide by all the rules and conditions assessed. Grading of the oil is permitted only in the premises mentioned in the Certificate of Authorisation.

7.3.2 Sampling and testing of oil

An authorised packer having a lot of oil of sandalwood ready with him, applies to the concerned Inspecting Officer *viz.* Assistant Marketing Officer, Essential Oils Grading Scheme, Kuppam; Senior Marketing Officer, Calcutta/Bombay/New Delhi and Deputy Senior Marketing Officer, Cochin/Kanpur, to make arrangements for sampling and inspection of the lot of the oil. A duly authorised Inspecting Officer thereupon visits his premises and takes a representative sample from the lot in the storage tank by means of a sampling tube. (See Fig. 7). The oil offered in bulk in a tank, after sampling, is packed into smaller containers, in the presence of the Inspecting Officer who puts his stamp on the soldered bung cover of each tin in such a way that the stamp is partly on the lid or bung cover and partly on the tin. Brand new tins are used for packing graded oil and the tins are checked for cleanliness and the soundness. From the representative sample, three test samples are prepared. Two of these samples (reference samples) duly sealed and bearing the number of the lot, date of sampling, name of packer etc. are handed over to the party while the third sample is sent for analysis to the Essential Oils Grading Laboratory Cochin-3. (See Fig. Nos. 8(a) & 8(b)) or the concerned Regional Agmark Laboratory at Kanpur, Bombay or Calcutta under code mark of the Inspecting Officer so as to maintain secrecy of its identity from the staff. The samples are subjected to complete analysis within 48 hours of their receipt in the Laboratory and the results are communicated to the Sampling Officer who in turn informs the party, if necessary telegraphically, indicating the percentage of free santalol in the lot sample.

7.3.3 Grading and Marking

On receipt of the results, the packer affixes the appropriate Agmark labels on the lid of each tin in such a way that the stamp placed by the Inspecting Officer is partially visible. The Agmark label is affixed with a special cellulose lacquer adhesive to ensure that the contents of the tin cannot be tampered without damaging the label. The guarantee to the buyer is the presence of the stamp placed by the Inspecting Officer at the time of sampling and filling the tin and the Agmark label showing the grade after the oil has been tested. Each Agmarked tin is marked with the name of the packer, place of packing, lot number and date of

sampling. An authorised packer can also have his private trade mark on the tins provided the same has been approved by the Agricultural Marketing Adviser to the Govt. of India.

When the quality of the oil is not satisfactory according to the analytical results obtained in the laboratory, the Inspecting Officer defaces his rubber stamp from the containers and no Agmark labels are permitted to be affixed.

7.3.4 Certificate of grading (*Annexure XII*)

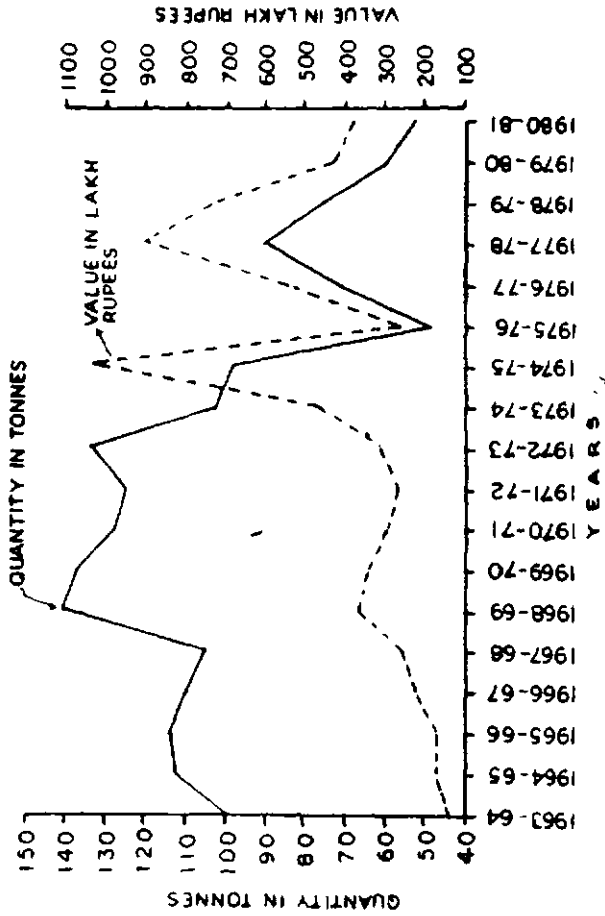
On the request of a packer, a Certificate of Agmark Grading in the form given in Appendix-V is issued to him. If he requires, an endorsement viz. "Despatch by part consignments permitted" is made on the Certificate so that the packer can export the oil in part consignments from the lot of the oil as and when required. Sometimes, when the packer considers it necessary, more than one certificate may be given for different part consignments of the same lot. The Certificate of Grading indicates lot number, grade of the oil, serial number of Agmark labels used on the tins and on the cases, free santalol percentage of the oil and the shipping marks on the cases or tins. If the graded oil is sold by a packer to some other party, a Certificate can be issued making an endorsement in the name of the actual shipper. The Certificate of Grading has to be produced by the exporter for inspection to the Customs authorities alongwith other documents, at the time of shipment.

The General Manager of the Government Sandalwood Oil Factory, Mysore, is authorised to analyse and grade the oil produced by the factory and issue a Certificate of Grading in respect of lots to be exported. A check is, however, kept by the Deputy Senior Marketing Officer, Essential Oils Grading Scheme, Cochin-3, to whom a copy of the Certificate and a duplicate sample of the lot has to be sent for examination. Officers of the Directorate of Marketing and Inspection exercise quality control through collection of check samples and periodic inspections.

7.4 Check Inspection

Duly authorised Officers of the Directorate of Marketing and Inspection draw samples from packages already graded and marked, from the premises of the packers, wharfs or any other place where the containers may be lying and send them for analysis to the concerned Regional Agmark Laboratory, Cochin and to other prescribed Regional Agmark Laboratories. The containers

GRAPH No. 6

GRADING OF SANDALWOOD OIL IN INDIA

are resealed after such check inspections. If the sample is not found to conform to the Agmark standards, the Agmark labels are withdrawn from all containers filled with the oil belonging to that particular lot number.

7.5 Grading for Internal Trade

Grading of oil of sandalwood for consumption within the country is not compulsory, although about 35 to 40 per cent of the total production is consumed internally. The scheme for grading the oil for export has been so successful that the Inter-State Joint Sandalwood Advisory Board has recommended compulsory grading of the oil for internal consumption also. Every encouragement is being given to the manufacturers to sell the graded oil for internal trade as well. A large number of *Attar* manufacturers have already started asking for Agmark graded oil and it is presumed that with the passage of time, the various manufacturers of the oil of sandalwood would, on their own accord, start selling only graded oil for consumption within the country too.

7.6. Progress of Grading

The quantity of sandalwood oil graded under Agmark and the estimated value realised for the years 1963-64 to 1980-81 are illustrated in Graph No. 6. From the graph, it can be seen that the quantity graded during the year 1968-69 was the highest. This was about 90.3 per cent of the total production of sandalwood oil in the country. Thereafter, the production of sandalwood oil and the quantity of sandalwood oil graded under Agmark declined. However, the percentage of produce graded under Agmark remained round about 80 per cent. Some quantity of sandalwood oil could not be covered under Agmark because of secret distillation by illicit distillers. Such type of production appears to be the main cause of not covering 100 per cent grading of sandalwood oil under Agmark. It will, therefore, be a difficult task to bring all produce under Agmark. But even then this is quite encouraging that the product graded under Agmark has got reputation in the country as well as abroad and all buyers have reposed faith on the commodity graded under Agmark. Both the production and grading have gone down in the recent years. Year-wise quantity and value of sandalwood oil graded under Agmark are given in Annexure VIII.

7.7. Some effects of the Introduction of the Grading Scheme

Almost all countries of the world except Great Britain, prefer oil of sandalwood of 90 per cent total alcohol expressed as

santalol. To ensure that only the best quality oil is exported from the country, the Agmark specifications have prescribed a very rigid and uniform standard of minimum 90 per cent free alcohol expressed as santalol. This can be obtained only when selected wood is distilled with great care and may even sometimes require further rectification of the oil. This step has been widely welcomed by the foreign buyers and has helped Indian oil of sandalwood not only to maintain its reputation in foreign countries but also to find new markets and develop export trade. Strict quality control on exports of the Sandalwood oil has eliminated complaints from foreign buyers regarding quality.

As each consignment of the oil exported is accompanied by a Certificate of Grading which indicates the exact free santalol percentage of the lot of oil, the foreign buyer gets to know the precise quality of the oil he purchases. This helps to facilitate transactions considerably fast without fear of further unnecessary disputes. The scheme has been in operation for the last 25 years. Its success in the export trade has encouraged the Indian consumer to ask for its enforcement on a compulsory basis even for trade within the country. A large section of the manufacturers and users of the oil of sandalwood and other interests concerned are in favour of enforcing compulsory quality control on the oil sold within the country too.

8. RESEARCH AND DEVELOPMENT OF SANDALWOOD OIL INDUSTRY IN INDIA

8.1 Difficulties of private distillers

8.1.1 Supply of sandalwood

To avoid many of the difficulties in Sandalwood trade, the Tamil Nadu Govt. is planning to exploit its resources of sandalwood by installing a State owned factory, as in Mysore. Previously, the Mysore Government used to auction 400 to 500 tonnes of sandalwood produced in certain parts of the State to the private distillers which they have now completely stopped. A new factory has been installed at Shimoga, to extract the oil of sandalwood. Thus they have channelised the entire supply of sandalwood to meet their annual requirement of these two factories. A part of it is met by purchasing sandalwood from Tamil Nadu auctions. This has caused a panic amongst private distillers. The decline in production of sandalwood has further aggravated the situation with the result that only a few factories are working to their full capacity. The management of Karnataka Soaps and Detergent Ltd. is not in favour of installing another factory at Tamil Nadu for its distillation. They are trying hard to arrive at a solution to distill the sandalwood in Karnataka distilleries and share the profit depending upon the quantity of sandalwood and yield of oil etc. The private distillers may further create some problems for sandalwood oil trade in case the sandalwood is not made available to their distilleries. The matter deserves careful scrutiny and consideration both at the Centre and the States' level.

8.1.2 Sales tax

The Sales tax rules vary from State to State which effect the cost of production and sale of sandalwood oil at different places besides a general expenditure in handling and transportation. In the interest of trade, it would be desirable to have uniform sales tax rules in all the States.

8.1.3 Supply of coal

Factories producing oil of sandalwood have reported that they are not getting sufficient coal for distilling sandalwood oil. Some of the factories have made provision to use furnace oil which is also available at quite high price. This attributes to the

higher cost of production and leaves a very small margin to compete with the other foreign traders in the world markets. The increased cost of production further makes it difficult to run the factories economically. Now Indian sandalwood oil trade is facing a stiff competition from the new emerging sandalwood producers in other countries of the world. It would be quite desirable to provide necessary energy sources at a cheaper rate so that India could have an upper hand in the world trade of sandalwood oil.

8.1.4 *New Synthetics*

Research laboratories of the reputed perfumery houses abroad are constantly engaged in total synthesis of the components constituting sandalwood oil from cheaper raw materials and petrochemicals. Many synthetic products are introduced in several markets for replacement of sandalwood oil in days of acute scarcity and high prices. The only way to avert and combat the inroads of synthetics is to keep the prices of sandalwood oil at a table level eliminating periodic fluctuations.

8.1.5 *Oil from smuggled sandalwood*

The oil obtained from sandalwood smuggled from the forests is causing a great imbalance in the prices. The quality of oil obtained is also not ensured as the ultimate object of these distillers is to extract maximum oil quantitatively. This resulted in inferior quality of sandalwood oil. The packers purchase oil at a cheaper rate than the market rate and blend it with other oil for its sale to the exporter or for internal consumption. Such wholesalers or packers get sufficient margin to sell produce at lower price and create imbalance to the detriment of genuine distillers.

8.2 **Adulterants of sandalwood oil**

High boiling esters like diethyl phthalate, glyceryl triacetate, benzyl benzoate, isopropyl myristate etc; alcohols like terpineol, benzyl alcohol, etc. and certain oils like castor oil, cedarwood oil, copaiba balsam, oil of guaiacum, liquid paraffin, etc. are all known to be the possible adulterants of east Indian Sandalwood Oil. A new adulterant viz. Morpankhi oil (*Thujo-Orientalis*) in sandalwood oil has been detected by Central Agmark Laboratory, Nagpur¹. This oil is very much similar to sandalwood oil. It has been detected by Thin Layer Chromatography as it gives various spots of different colours at different R.F., as compared to pure sandalwood oil.

¹Baiswara R.B. *et al* Nair, K.N.G., and Mathew T.V.,—Thin layer chromatography method for the detection of oil of sandalwood with oil of 'Morpankhi' Res. & Ind. 20 (4): 213—216, 1975.

Oil Erythoxylon—monogynum is often used as an adulterant upto the extent of 40 per cent. The adulteration can, however, be detected after 24 to 30 hrs. because the adulterant starts fermenting and creates a bad odour against a pleasant and permanent odour of sandalwood oil.

8.3 Chemical Composition*

The chief constituents, amounting to 90 or more per cent of the oil is Santalol, a mixture of two primary Sesquiterpene alcohols $C_{15}H_{24}O$ namely α and β Santalols. in which the α form predominates.

The following compounds have been reported in East Indian Sandalwood Oil:—

1. Isovaleraldehyde, (C_4H_8CHO) in the foreruns of the oil and also another aldehyde b-50°-130°C.
2. Santene (C_9H_{14}) in the low boiling fraction of the oil.
3. Nortricycloekasantalane (?) A saturated hydrocarbon C_{11} , H_{18} , b-183°C d_{15} 0.9133, d_{20} 0.9092, 1-D-23° 55', n_D^{20} 1.47860 which is identical with nortricycloekasantalane.
4. L—Santenone ($C_9H_{14}O$) The fraction 65°-80°C (b-180°-200°C) of East Indian Sandalwood oil contains a ketone and is reported to be identical with II—Norcamphor and santenone.
5. Santenone alcohol (Santenol) is reported in the fraction b-196°-198°C.
6. Teresantalol ($C_{10}H_{16}O$) is found in the fraction of b-210°-220°C of East Indian Sandalwood oil.
7. Nortricycle eka santalol ($C_{11}H_{16}O$) is present in the fraction b-222°-224°C.
8. Santalone ($C_{11}H_{16}O$) is found in the fraction b-213°-216°C. Another Ketone having same empirical formula is also stated to be present in the oil and is probably an Isomer of Santalone.
9. α - and β Santalene ($C_{15}H_{24}$) are the two sesquiterpenes present in East Indian Sandalwood oil.
10. α & β Santalol ($C_{15}H_{24}O$) occurs as a chief constituent in East Indian Sandalwood oil, in which α form predominates.
11. Tercsantallic acid ($C_{16}H_{24}O_2$) occurs in the oil partly free, partly in esterified form.
12. Santalic acid ($C_{15}H_{22}O_2$) and other unknown/unidentified acids are also present to some extent in sandalwood oil.
13. Phenols of strong and disagreeable odour and Lactones of fruity odour have been reported but none of them could be reported to be identified. Borneol like odour has also been noted and is stated to be probably due to santenone alcohol.

*The Essential oils—Ernest Gunther Vol-V, 1975.

8.4 Need for sophisticated Analysis

In order to maintain the reputation of *attars* and other perfumes manufactured in India, it is imperative that good quality oil of sandalwood should be made available to the manufacturers. The manufacturers of oil of sandalwood should therefore, take special care to grade the entire quantity of oil produced by them. The present standards for essential oils often fail to give as much information as desirable by various buyers because essential oils are complex in nature and are difficult to study as a whole. Accordingly buyer prefers Gas Liquid Chromatographic (G.L.C.) analysis of essential oils. Many countries have followed it and International Standards Organization Technical Committee (I.S.O./T.C—54) has also given due recognition to them.

The question of quality control has been of great concern to all. The International Standards Organisation had set up a Technical Committee (I.S.O./TC—54) to guide on various matters of essential oils in 1947 which was later on recognised in 1951 to bring together the interests of producers, traders, users, Govt. and scientific community. India (ISI) is also one of the members of the body. International Standards Organization I.S.O. has brought out a number of documents on Essential Oils which can be seen at Annexure XIV.

8.5 Publicity

It is now well-known that Indian oil of sandalwood has secured a high position in the world market. Its quality is universally recognised as superior to that of any other "so-called oil of sandalwood". Credit for the pioneering efforts, no doubt goes to the "Government of Mysore" which undertook extensive publicity work in foreign countries to show the superiority of the Indian oil produced from *Santalum album, Lin.* The threat of competition from other types of the so-called oils of sandalwood is very much in the world market and the need to continue adequate publicity in foreign countries is an urgent one. The quality control scheme at present enforced on exports of oil of sandalwood from India has been working successfully and it would be desirable to keep the foreign buyers informed of the same and other similar developmental programmes through extensive propaganda. Such publicity could be done advantageously under the aegis of the Central or State Governments with a view to sustaining the demand for Indian oil of sandalwood.

8.6 Mutual Allowance for Quality

Trade should be so developed, both internally and for export, that there is a mutual allowance for the quality of oil based

on its santalol content. The cooperation of the Inter-State Joint Sandalwood Advisory Board and the manufacturers of oil of sandalwood and *attars* etc. should be sought to finalise standard contact terms in this regard.

8.7. New Developments—Synthetic Substitutes

During the recent years, synthetic substitutes are posing a serious competition for the natural oil both in terms of wider use and low price structure. According to the reports received it is learnt that none of the substitutes can be claimed as the perfect synthetic recreation of the natural sandalwood aroma. Following are some of the synthetic substitutes:—

- (1) SANDELA, hydrogenated isomers of isobornyl and camphyl cyclohexanols. This is the most successfully marketed substitute today. Its cost is one-third of the sandalwood oil.
- (2) SANTALYDOL, obtained by alkylation of guaicol with camphena and subsequent hydrogenation.
- (3) ISO BORNEOL METHOXY CYCLOHEXANOL.
- (4) DECA HYDRO BETA NAPHTHYL FORMATE
- (5) Hydrogenated CATECHOL-CAMPHENE Condensates.
- (6) Hydrogenated &—FORMYL CAMPHENE-ACETONE condensate.

The important manufacturers of the synthetic substitutes in different countries alongwith the trade names are given below:

Sl. No.	Trade Name	Manufactured by
1.	Sandola G.D.	M/s Givaudan & Cie, Geneva, Switzerland.
2.	Santalys I.F.L.	M/s Lautier, Fils, Greece, France.
3.	Sandel H&R	M/s Haarman & Reimer Ltd., Surrey, Great Britain, U.K.
4.	Santalex	Manufactured in Japan.

China is also reported to be a manufacturer of synthetics.

India has also kept a pace with the other countries in manufacturing the sandal note bearing chemicals such as Decanyl formate, iso-borneol methoxy cyclohexanol and camphene. Decanyl formate is being manufactured from naphthol. These chemicals were preferred by the *agarbatti* manufacturers because the prices of these synthetic chemicals are around Rs. 450/- a Kg. which was nearly half of the price of sandalwood oil.

8.8 Basic Chemicals, Pharmaceuticals and cosmetics—Export Promotion Council.

When the first brochure on the marketing of sandalwood oil in India was published, there was no organisation to facilitate and encourage export of sandalwood oil. After sixties, a number of basic inorganic and organic chemicals, cosmetics etc. evolved and took to production in the country to export and import for various purposes, depending upon the existence of supply and demand the world over. A need was then felt for establishing an organisation to promote the interest of these products. The Govt. of India under the Ministry of Commerce set-up an organisation known as Basic Chemicals, Pharmaceuticals and Cosmetics Export Promotion Council, (CHEMEXCIL) with the Head Office at Jhansi Castle, Fourth Floor, 7 Cooperage Road, Bombay. The object of this organisation is to promote the exports of drugs, pharmaceuticals and fine chemical dyes, intermediates, basic inorganic and organic chemicals including agrochemicals, cosmetics and toilettries, *agarbattis*, Essential Oil substitutes and crude drugs. Sandalwood oil also falls under the purview of this Council.

The exporters of sandalwood oil under the current policy are eligible for one per cent replenishment licence which is essentially meant for import of packing materials. Sandalwood oil exporters enjoy this facility by becoming the member of this Council. However, the exporters of sandalwood do not enjoy this facility as sandalwood does not fall under their purview although the other items like *agarbattis* and other finished products where sandalwood powder is used as a raw material are likely to be covered by this Council.

The Council keeps abreast with the developments in the markets abroad and such informations are circulated to the members from time to time. The Council also organises meetings and seminars to discuss the various problems related to exports and to keep itself aware with the news and views of scientists, technocrats and other exporters on different subjects concerning to their organisation. Under the provisions they can call or hold the meetings of the Council on 15 days' notice. The Council although is a Government Organisation, usually invites the private traders to express their views before the Council, however, the Council is dealing with the sandalwood oil trade but it does not have the data on the production, inter-state movements, existing demand in different countries, further use of sandalwood oil for finished products in the country or any such approach to establish an industry to create more employment and foreign exchange fetching material due to their restrictive work.

9. SUMMARY AND RECOMMENDATIONS

9.1. Summary

The sandalwood oil trade has been the monopoly of India from the very ancient times till early sixties of this century. In the early sixties, Australia appeared as a stiff competitor to India but failed to grab the sandalwood oil trade in the world market. Thereafter, a number of countries saw silverlining in sandalwood oil trade. They explored the possibilities to raise as well as to search the sandalwood plants, its family or the other species resembling to some extent in its oil characteristics. This rivalry brought to light the sandalwood plants of the countries like Mauritius. The major competitor of India in the world market now is Indonesia. It is a matter of concern to find that a number of countries have come up as new exporters of sandalwood oil and on the other hand the production in India has declined significantly bringing down the valuable foreign exchange earnings to the Indian exchequer. The production of sandalwood oil has dwindled from about 170 tonnes in 1969-70 to merely 70 tonnes at present.

Indian factories are following steam distillation techniques for the extraction of sandalwood oil. The primitive technique of hydro-distillation has been dispensed with. However, the recovery of oil by steam distillation is slightly low and there are chances to get more yield provided some sophisticated distillation technique is devised and followed. This technique is also much time-consuming and a single lot takes about a week or so for its distillation. This also increases the cost of production of sandalwood oil. A reference of continuous distillation method devised in U.S.S.R. has come to notice. It would be quite appropriate if the Indian manufacturers or technocrats go to this country and study the feasibility of its use in our country for sandalwood oil distillation. Solvent extraction technique for extraction of oil has also been suggested but no specific opinion on the suitability of oil could be drawn. Another method using carbon dioxide at a critical temperature has been suggested as an extraction media by a French Scientist. The suitability and feasibility of the process can be tried, and if we succeed the same may give maximum yield of sandalwood oil. At the same time, an apprehension of side note of wood by this method may also be studied. For the rectification of oil, the cut-technique followed by the trade and the appropriate selection of wood appears to be satisfactory for general trade.

Sandalwood oil has been used in the past for perfumery and medicinal purposes. But now-a-days its medicinal use has no significance. In the internal consumption, most of the oil is used in the preparation of perfumes and *attars* etc. Nearly 70 per cent of the total internal consumption is in *Attar* preparation while 5 to 10 per cent is used in perfumes and nearly the same percentage is consumed in soaps and toiletries. Only about a tonne is stated to be used in the manufacture of good quality *Agarbattis*. Remaining quantity is utilised for other miscellaneous purposes. Thus round-about 35 to 40 tonnes of sandalwood oil production is used within the country and the rest of it is exported to different countries of the world. The U.S.A. was the chief importer of sandalwood oil in the past. France, U.K., and U.S.S.R. are the other major buyers. Now U.S.A. is also importing sandalwood oil from Indonesia. No doubt, the Indian sandalwood oil is also being imported by it but the quantity has gone down considerably.

The sandalwood oil prices also fluctuate depending upon the availability and demand in both internal and external markets. Upto 1972-73 the prices were almost stable. But later on, steep fluctuations have been observed in the Indian market. A slump was noticed during 1979-80 but thereafter the prices have shown a slow and steady rising trend. In world markets the Indian sandalwood oil maintained its first position in getting highest price than any of the oil from other countries. India could achieve this position because of its strict quality control over the product.

For the present, assembling and distribution of sandalwood oil to the extent of 90 to 95 per cent is done by factory owner himself. The factories are in a position to get 90 to 92 per cent of the share from the price what a consumer pays.

Till the early fifties, sandalwood oil used to be exported without any certification mark for its quality. This had caused a set back to the quality of produce and thus reputation in the foreign countries. Therefore, a need was felt to grade the product before its export to any country to maintain the reputation of Indian produce in the world markets. Agmark specifications for oil of sandalwood have been prescribed under Essential Oils Grading and Marking Rules, 1954, promulgated under the provisions of Agricultural Produce (Grading and Marking) Act, 1937. Agmark certification is carried out on the basis of well established and recognised standards. These standards have enabled the trade to enter into contracts on the basis of quality description. The

quantity to the extent of 90 per cent of the total produce of India has been brought under Agmark grading. Slight fluctuations have been observed but the graded product has never gone below 80 per cent of the total sandalwood oil production in the country. Thus the confidence reposed in Agmark certification by the trade circles is not confined only to export trade but also to the internal trade. The entire produce exported carries an Agmark Certificate which has maintained its credit and frame in the world markets. Now most of the consumers in the country, for internal consumption also go for Agmark certified sandalwood oil.

9.2 Recommendation

1. The production of sandalwood oil has declined significantly affecting the foreign exchange earnings also. It requires immediate attention to increase the production so that the country could have foreign exchange to bridge the gap of trade balance.

2. The distillers are not getting sufficient fuel like coal etc. at reasonable prices for the distillation of sandalwood oil. Such foreign exchange earning industries require an extra attention to be paid in order to keep down the production cost in the wake of competition with other countries in the world market.

3. There is an urgent need to evolve efficient and better methods for extraction of oil. Although some techniques like vacuum steam distillation and extraction of oil at sub-zero temperature with the liquified hydrocarbon and carbondioxide are known but their commercial utilisation for extraction of sandalwood oil is a question mark for the reason of uncertainty to maintain the characteristics note and value of the Indian sandalwood oil well known to the foreign buyers. An achievement in this direction may reduce the production cost which in turn will leave more scope for competition with other countries.

4. India is exporting sandalwood oil as a raw material to other countries for more than a century, though it was stated to be one of the important perfumers of the world. We could not make any strides in the development of perfumes trade using sandalwood oil as a base in spite of favourable position of flora and fauna in the country.

5. We have imported essential oils/resinoids worth 35.1, 50.6, 46.1 and 50.8 million rupees in the year 1977-78, 78-79,

79-80 and 80-81 respectively. Majority of these items are produced/have got base in the country. A little effort to cultivate such essential oil crops in the country can save the drainage of so much money from our exchequer and can also reduce to some extent the burden of foreign exchange. The details of such imports are given in Annexure X-B. It reveals that the production of these essential oils will not only help in establishing/strengthening a number of perfumeries in the country but will also create employment to farmers and other intermediaries. Besides newly developed essential oils on exports as such will bring a lot of foreign exchange to country's exchequer.

6. There is a good potential for export of joss sticks in world market. These resources should be tapped but it should be ensured that only genuine and quality products are supplied to foreign markets so that the reputation of the country and products remain intact. Unfortunately, whenever and wherever India has lost her business in the past, it was because of poor or no quality control. Although preshipment inspection to export items is in vogue but such items sometimes go unnoticed and bring a bad name to the country. A strict quality control and supervision is the need of time.

7. Periodic visits of technical staff of reputed concerns and institutions to famous perfume manufacturing countries would be of tremendous help for the growth of this industry. It may also bring new projects for further utilisation of raw materials in the country. These technicians/trade delegations should also visit the major essential oil importing countries of the world to assess their demand, quality desired by them and feasibility to increase our exports particularly in the form finished products. They should also explore the possibilities of technical collaboration for the manufacturing of perfumes in the country. Some of the important countries are France, Switzerland, U.S.A. Japan and U.S.S.R. Our efforts should be such that the value added final products manufactured in the country are exported to other countries to the maximum extent rather than exporting raw materials.

8. A number of synthetics have also been developed by some countries as substitutes of sandalwood oil. But there are very little chances to substitute the natural sandalwood oil by them as no artificial note can exactly reproduce the richly smooth and velvety note of natural sandalwood oil. Only the price factor may affect the sandalwood oil trade which can be overcome by increasing its production. The amplified growth/production of

sandalwood will have multi-utility in various fields like control over pollution, check of soil erosion and more employment opportunities. The uninterrupted supply of sandalwood oil stable price may be the other major factors to maintain export tempo and its credit in the world market which can also be controlled by increase in production.

9. The Basic Chemicals and Pharmaceuticals Export Promotion Council is looking after the export of sandalwood oil in the interest of sandalwood trade and industry. But the progress is at the lowest ebb which is evident from the Indian share of essential oils in the world trade. It is only about 0.2 per cent. Brazil having the similar climatic condition stands 7th in the major world exporters of essential oils. Therefore, India do have ample scope to improve its share in the world essential oil trade.

10. Although a Joint Inter-State Sandalwood Advisory Board is in existence but the same does not appear to be effective in achieving the desired goal *i.e.* the availability of sufficient quantity of sandalwood to the sandal distillation units, development of trade and essential oil based industries in the country. Probably, it is due to the limited scope of work assigned and resources available with the Board. For the utilisation of essential oils as raw material and development of essential oil industries, a systematic approach and proper planning is needed in view of the increasing demand for perfumes in the country as well as in the world markets. This invites to establish an independent organisation at the central level on the pattern of rubber, tea and coffee boards for an all round development of this trade and industry in the country. This would also serve the purpose of creating more employment and to promote earning from foreign exchange. This organisation may also maintain data on production and demand in India and abroad. The implementation of the latest research and developments in this field in the country and abroad may be other functions besides the policy planning and execution of essential oil based schemes for the purpose of industrial growth, maintenance in general and exploitation of other essential oils resources. Therefore, setting up an organisation like *Essential Oils Board* may provide a solution to achieve these goals.

ANNEXURES

ANNEXURE I

Statewise estimated production of Sandalwood Oil in India and their share percentage for the year
1963-64 to 1980-81 (Qty. in M.T.)

Years	States												Total
	Andhra Pradesh		Karnataka		Kerala		Maharashtra		Tamil Nadu		Uttar Pradesh		
	Qty.	Percentage	Qty.	Percentage	Qty.	Percentage	Qty.	Percentage	Qty.	Percentage	Qty.	Percentage	
1963-64	13.74	11.81	85.65	73.0	..	..	3.00	2.5	7.07	6.10	6.83	5.7	116.29
1964-65	15.35	11.27	102.13	25.0	..	..	3.00	2.2	8.76	6.4	6.91	5.0	136.15
1965-66	18.73	12.35	114.37	74.8	..	..	3.00	1.9	9.06	5.9	7.62	4.9	152.78
1966-67	16.41	10.84	117.27	27.8	..	..	3.00	2.0	7.22	4.8	7.08	4.7	150.98
1967-68	16.42	10.6	117.47	25.92	..	..	3.00	1.9	6.41	4.1	11.41	7.13	154.71
1968-69	16.09	10.3	117.30	25.23	..	..	3.00	1.9	7.23	4.6	12.08	7.7	155.70
1969-70	17.89	10.5	120.38	23.0	..	..	3.00	1.8	8.57	5.2	15.08	9.1	164.92
1970-71	14.93	9.0	111.75	67.4	..	..	3.00	1.8	9.58	5.8	16.33	9.8	165.59
1971-72	14.05	8.8	118.07	73.9	..	..	3.00	1.8	7.91	4.9	16.66	10.4	159.69
1972-73	19.98	12.2	120.37	73.5	2.10	1.3	3.00	1.8	5.26	3.2	12.27	7.5	162.98
1973-74	13.42	10.0	95.58	71.7	4.11	3.1	3.20	2.4	5.19	3.8	11.64	8.7	133.24
1974-75	14.81	15.3	62.65	64.8	2.91	3.0	3.10	3.2	2.66	2.7	10.44	10.8	96.57
1975-76	7.71	10.6	45.28	62.67	2.75	3.8	3.00	4.2	4.63	6.6	8.38	11.6	72.25
1976-77	13.67	15.2	52.15	28.0	2.00	2.2	3.00	3.3	5.22	5.8	13.84	15.4	89.88
1977-78	13.48	12.0	75.92	68.4	3.34	2.9	3.00	2.7	4.52	4.0	11.34	10.16	111.60
1978-79	9.64	11.7	49.82	60.7	3.42	4.1	3.00	3.6	2.20	2.6	14.00	17.0	82.08
1979-80	5.55	8.0	44.12	63.9	1.84	2.7	3.00	4.4	3.38	4.9	11.06	16.0	68.95
1980-81	5.41	7.6	45.20	63.5	2.0	2.8	3.00	4.2	4.79	6.7	11.0	15.4	71.20

ANNEXURE II

Physical & chemical characteristics of Sandalwood Oil of different countries

	Specific gravity	Optical rotation	Refractive index	Free alcohol (Santalol content)	Solubility in 70% (by vol. ethyl alcohol)	Remarks
1	2	3	4	5	6	7
1. Grade 'A' (East Indian Sandal Wood Oil)	0.962 to 0.976 at 30°/ 30°C	-15° to -20°	1.4990 to 1.5060 at 30°C	Not less than 90%	Soluble in 5 volumes.	The East Indian Sandalwood oil shall be the pale-yellow or nearly colourless essential oil obtained by steam distillation and/or water distillation of <i>Santalum album</i> , Linn, only, and shall be free from admixture with any other oil or substance. It shall be clear, free from sediment and suspended matter. It shall be dry and shall have the characteristic faint but persistent, odour and pleasant taste.
2. West Australian (a) Natural	.958 — at 15°/15°C .972	-0.25 to -0.87	1.503/1.509	69.3 to 80% total alcohol sesquiterpene alcohol	Insoluble in 70% alcohol.	The wood is known as <i>Fusanus spicatum</i> . It is stated that its oil is obtained from the wood of <i>Santalum spicatum</i> obtained by a combination of solvent extraction and steam distillation of wood. It is rather bitter resinous, pale-yellow viscous liquid.

1	2	3	4	5	6	7
(b) Processed	.969 — at 15°/15°C .9725	—3.0 to +5.0	1.505/ 1.506	94.3 to 95.4 % Total re- ckoned as santalol sesquiterpene alcohol.	1 in 3 to 3.5 vol. in 70% alcohol.	
3. West Indies .	.950 — at 15°C/15°C .984	+19.0° to +53.3	1.505/ 1.513	No santalol	Insoluble in 70% alcohol (1 in 3 of 80% alcohol)	Reported to have been obtained from tree: <i>Amyris balsamifera</i> linn.
4. East Africa	.9477—at 15°C/15°C	—42.56°	1.5219	No santalol	Insoluble (1 in 7/8 of 90% alcohol)	Sesquiterpene alcohol 35%. Probably obtained from the tree <i>Oxyris tenuipolia</i> .
5. Mauritius (Heart- wood). Sapwood	.9786 to .9816 .9808	—20.55° —21.15°	1.5055 1.5067	96.4% as santalol 96.8% as santalol	1 in 3.5 vol. of 70% alco- hol. Do.	
6. Thursday Island Sandalwood Oil Fiji Sandalwood oil	.9622 to .9687 .9768	—24°22' to 37°30' —25.5°		4 to 5 vols. of 70% alcohol		Product of <i>santalum yasi</i> .
Refs.	1	Agmark Specification—D.M.I.				
	2					
	3	Iyengar A.V.V. East Indian Sandalwood Oil				
	4					
	5					
	6					

ANNEXURE III

Export of Sandalwood Oil from India for the years 1960-61 to 1980-81

Countries	Quantity in Kg. Value in Rupees.					
	1960-61		1961-62		1962-63	
	Qty.	Value	Qty.	Value	Qty.	Value
1	2	3	4	5	6	7
Australia	69	9988	240	53157	..	..
Ceylon	1054	179274	227	46875	842	159076
Czechoslovakia . . . . .	..	..	..	..	..	..
France	18229	3161540	15878	3281272	14180	2488003
German FRP	636	119390	2984	625473	2639	465245
German DRP	4648	807137	..	..	2543	509547
Ghana	33	6325	..	..	33	5490
Hongkong	255	42410	493	106794	114	22756
Hungary . . . . .	..	..	..	..	127	25200
Indonesia . . . . .	..	..	..	..	..	..
Italy	246	44044	582	123349	272	46394
Japan	17531	5053864	13267	2756372	5917	1067155
Netherland	4503	806269	2142	448477	2497	467130

ANNEXURE III—Contd.

1	2	3	4	5	6	7
Neth Ant.	..	..	..	..	..	..
Poland	..	..	160	32800	..	..
Rumania	..	..	..	..	..	..
Singapore	8	1666	54	11860	6	748
Spain	..	..	50	10033	172	25302
Sudan	1233	212204	1721	337070	2077	379021
Sweden	..	..	..	..	..	..
Switzerland	2432	420584	2507	497090	2729	495024
Thailand	666	113750	205	42400	511	79228
U.K.	24347	4522499	19140	4089788	7056	1134289
U.S.A.	14389	2473125	19249	3969396	17938	3120662
U.S.S.R.	3840	743325	9946	2264870	10607	1997054
Yugoslavia	..	..	..	..	..	..
Dubai	..	..	..	..	..	..
Others	3884	690953	2901	624219	1958	366431
Total	98003	1748347	91746	19321295	72218	12853755

Export of Sandalwood Oil from India for the years 1960-61 to 1980-81—Contd.

Countries	Quantity in Kg. Value in Rs.					
	1963-64		1964-65		1965-66	
	Qty.	Value	Qty.	Value	Qty.	Value
1	2	3	4	5	6	7
Australia	390	61360	380	57016	489	76266
Ceylon	2433	363929	533	81235	1014	162347
Czechoslovakia	1000	150700	964	141600	844	127750
France	11949	1792872	15890	2309663	11932	1757182
German FRP	2288	348967	2576	380276	1582	221394
German DRP	1041	150564	400	57600	2370	351620
Ghana	70	11358	43	6775	69	11643
Hongkong	1750	259280	1118	169942	1084	184197
Hungary . . . . .	..	..	4033	590900	1900	310200
Indonesia . . . . .	..	..	..	..	..	..
Italy	555	67654	1125	168008	600	90758
Japan	11529	1823663	10564	1603888	5847	184197
Netherland	3304	490636	2472	373771	4069	591235

1	2	3	4	5	6	7
Neth Ant.	..	..	..	..	..	..
Poland	396	57348	..	..	..	-
Rumania	..	..	..	..	..	..
Singapore	..	..	1	204	..	..
Spain	160	23047	562	75493	789	107245
Sudan	3135	491988	2783	443843	3878	610136
Sweden	..	..	40	6250	..	..
Switzerland	1578	235723	3233	485667	3250	486150
Thailand	681	89261	542	77787	232	36375
U.K.	2587	1978093	14341	2217729	11018	1718677
U.S.A.	15436	2243147	22642	3328650	20477	3054051
U.S.S.R.	5443	851625	6839	1046326	14376	2256383
Yugoslavia	4425	647126	3454	484783	3300	489232
Dubai	..	..	..	..	..	..
Others	965	151774	2614	411576	274	639114
Total	81112	12290115	97149	14518982	89394	13466152

Export of Sandalwood Oil from India for the years 1960-61 to 1980-81—Contd.

Countries	1966-67		1967-68		1968-69		1969-70	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
	1	2	3	4	5	6	7	8	9
Australia	240	58450	310	75090	370	101000	200	54487
Ceylon	1234	289788	1225	316484	1376	368797	110	30259
Czechoslovakia	517	117088	584	136800	1162	298500	..	..
France	18879	4351245	19020	4496910	24500	6047409	17750	4527095
German FRP	1141	269656	1711	428567	1695	430055	1590	361893
German DRP	300	68400	1185	330485	435	123975	1090	680300
Ghana . . . . .	..	..	..	..	..	..	95	25773
Hongkong	157	39065	311	86172	944	262530	691	157455
Hungary	1345	307100	5368	622100	1240	326000	1840	437660
Indonesia . . . . .	..	..	..	..	..	..	..	..
Italy	350	80925	1100	285095	767	191867	800	191758
Japan	5421	1287155	6002	1456928	8000	1971446	5660	1434017
Netherland	5200	1241684	8451	211878	20078	5167856	14100	3431124

Qty. in Kg.
Value in Rs.

	1	2	3	4	5	6	7	8	9
Neth Ant.	..	..	..	..	..	..	..	..	..
Poland	..	..	1270	327614	3640	973789	..	..	..
Romania	..	..	..	..	..	..	..	..	..
Singapore	..	..	420	29000	..	..	..	..	..
Spain	478	99875	1087	133908	840	213702	420	100400	
Sudan	2627	618857	3699	940105	5004	1425704	5060	1350272	
Sweden	..	..	300	81274	..	..	..	..	..
Switzerland	4504	1081207	6100	1465284	6700	1655252	7409	1862095	
Thailand	150	36075	..	..	54	13835	74	16498	
U.K.	11870	2726383	11886	2912485	9600	2459192	9100	2368701	
U.S.A.	16080	3447553	12157	2970775	16284	3970339	8740	2249836	
U.S.S.R.	13680	2875608	8480	2154900	12964	3466766	17866	4413975	
Yugoslavia	5800	1316311	8525	2231758	6793	1850638	10500	2595439	
Dubai	..	..	..	..	..	..	..	..	..
Others	540	11372	60	15894	598	169439	5017	1187198	
Total	90513	20426137	98951	23609506	123044	31488091	108112	2747635	

Export of Sandalwood Oil from India for the years 1960-61 to 1980-81—Contd.

Qty. in Kg.
Value in Rs.

Countries	1970-71		1971-72		1972-73		1973-74	
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
1	2	3	4	5	6	7	8	9
Australia	250	70501	490	108936	460	115705	260	111194
Ceylon	475	111530	200	47815	99	21839	91	22574
Czechoslovakia	860	185190	1050	232689	..	..	..	..
France	11920	2948949	16916	3832434	19567	4489957	12533	4128911
German FRP	370	87355	2290	491886	1200	307293	900	440757
German DRP	4030	921214	1659	361651	..	..	..	..
Ghana . . . . .	..	..	50	12500	..	..	25	5625
Hongkong	150	43614	210	55785	245	64598	140	29013
Hungary	2235	546300	3310	717935	3980	858498	5640	1767742
Indonesia . . . . .	..	..	10	3200	..	..	..	..
Italy	651	158129	900	210364	400	95032	600	183775
Japan	6800	1680342	6500	1483723	7758	1828502	9130	3849304
Netherland	10730	2397199	3760	829036	5630	1297766	5100	1600121

1	2	3	4	5	6	7	8	9
Neth Ant.	250	53000	50	11100	..	..	..	:
Poland	6330	1409607	2320	501332	1950	440358	2960	81113
Romania	..	..	9	1989	..	..	..	..
Singapore	..	..	80	18276	590	132516	20	5100
Spain	200	48000	275	64316	600	135624	400	140303
Sudan	7085	1625992	5573	1351323	3270	803594	1164	308874
Sweden	160	36000	250	54206	..	..	..	..
Switzerland	8700	2151235	6850	1552314	8050	1850602	4200	1490700
Thailand	202	47461	130	31302	369	87077	815	230526
U.K.	8400	2149579	10800	2585380	12010	2859944	6450	2179531
U.S.A.	13560	3164112	32825	7029775	43541	10170139	34663	14972852
U.S.S.R.	16425	3778375	13966	2894800	9500	2103250	7000	2575500
Yugoslavia	2730	632691	7438	1614501	500	109000	..	..
Dubai	..	..	..	..	..	..	..	..
Others	1260	293960	..	..	207	49018	576	252900
Total	103755	24540335	117911	26098563	119931	27820312	92667	35116436

Source :- Monthly Statistics of the Foreign Trade of India.

Export of Sandalwood Oil from India for the years 1960-61 to 1980—Contd.

Countries	1974-75		1975-76		1976-77	
	Qty.	Value	Qty.	Value	Qty.	Value
	2	3	4	5	6	7
Australia	160	14811	..	..	..	..
Ceylon . . . . .	..	..	..	..	4	3472
Czechoslovakia . . . . .	..	..	..	..	..	..
France	11662	11857684	1993	730455	3750	3008685
German FRP	1000	1047416	520	273581	515	340784
German DRP . . . . .	..	..	907	593275	..	..
Ghana . . . . .	..	..	..	..	..	..
Hongkong	15	20418	179	141432	110	65141
Hungary	1590	1707540	1200	494351	662	351135
Indonesia . . . . .	..	..	..	..	..	..
Italy	200	244276	..	..	200	122450
Japan	3014	2567003	202	99091	390	319283
Netherlands	1035	1021496	60	33000	100	107200

1	2	3	4	5	6	7
Neth Ant . . .	..	..	..	..	..	..
Poland . . .	600	668000	-	..	-	-
Romania . . .	..	..	..	..	..	..
Singapore . . .	..	..	78	43160	94	65247
Spain . . .	613	663241	50	31900	300	251722
Sudan . . .	759	754563	606	364932	602	414200
Sweden . . .	..	..	..	..	..	..
Switzerland . . .	6250	7418041	37	21244	400	367101
Thailand . . .	..	..	145	74307	..	..
U.K. . . .	3700	3572528	315	197794	1459	1154758
U.S.A. . . .	24073	23819289	6680	3361011	8610	6645611
U.S.S.R. . . .	16486	15167380	1434	5036603	4350	3318337
Yugoslavia . . .	..	..	..	..	..	..
Dubai . . .	..	..	256	166253	25	21650
Others . . .	270	191813	2553	1431387	620	427357
Total . . .	71427	70868799	22705	19993776	22351	16984133

Export of Sandalwood Oil from India for the year 1960-61 to 1980-81—Contd.

Countries	Qty. in kg. Value in Rs.								
	1977-78		1978-79		1979-80		1980-81		
	Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value	
1	2	3	4	5	6	7	8	9	
Australia	10	11000	155	193274	220	231933	160	138950	
Ceylon . . . . .	..	..	..	..	..	..	..	..
Czechoslovakia . . . . .	..	..	..	..	..	..	..	..
France	1024	1143909	3567	3216906	6718	5572667	7091	5435074	
German FRP	713	842686	730	587433	1622	1345918	375	242824	
German DRP . . . . .	..	..	..	..	..	..	..	..
Ghana . . . . .	..	..	..	..	..	..	..	..
Hongkong	227	292026	900	967350	200	195254	30	23150	
Hungary	500	655049	..	..	..	..	..	..
Indonesia . . . . .	..	..	..	..	..	..	..	..
Italy . . . . .	..	..	..	..	..	..	240	183797	
Japan	875	1094055	1428	1524781	3078	2798987	2701	2118912	
Netherland	166	193682	100	80570	672	525079	940	691443	

1	2	3	4	5	6	7	8	9
Neth Ant.	..	..	..	..	..	..	..	..
Poland	..	..	..	..	..	..	..	..
Romania	..	..	400	420761	..	..	..	..
Singapore	100	99843	200	148030	180	169150	70	46835
Spain	229	298214	2583	2985220	2851	2902471	345	265623
Sudan	1427	1880522	..	..	..	..	4427	4654686
Sweden	..	..	900	1067655	2527	2289936	..	..
Switzerland	825	1087595	60	61837	280	182963	1656	1254330
Thailand	25	25681	820	740367	3400	3131874	250	187933
U.K.	559	747185	8670	7792043	7770	6556048	2699	2064925
U.S.A.	8276	10506372	4100	3634049	12171	7097471	6670	5123903
U.S.S.R.	6850	8618176	..	..	..	..	6774	4669744
Yugoslavia	..	..	..	..	..	..	..	..
Dubai	..	..	..	..	..	..	..	..
Others	841	1076099	680	618854	1163	1231586	3210	2337449
Total	22647	28572084	25293	24039630	43001	34347789	37638	29647978

ANNEXURE IV

Export of essential oils for important countries

(Values in million U.S. dollars)

Sl. No.	Country	1974	1975	1976
1.	France	191	160	203
2.	U.S.A.	113	98	133
3.	Switzerland	92	100	123
4.	Netherland	79	72	91
5.	U.K.	79	71	83
6.	G.F.R.	50	44	57
7.	Brazil	38	22	21
8.	Italy	28	16	21
9.	Egypt	17	27	17
10.	Hong Kong	14	14	16
11.	Spain	16	10	13
12.	Indonesia	19	10	12
13.	Japan	10	11	14
14.	Ireland	9	13	16
15.	Others	136	82	41
	Total	891	750	861*

*Incomplete.

Source :—Year Book of International Trade Statistics 1976, Vol. 2, United Nations, New York (Page 104).

ANNEXURE V

Rates of Mysore Government Sandalwood Oil in export markets

Year	Rate per Kg in US \$
Pre-war	3.5 to 4.00
1941	5.00
1942	7.00
1943	9.52
1944 to 1948	13.00
1949 to 1950	12.12
1951	11.00
15-1-1952	9.00
15-5-1952	9.00
15-3-1953	9.00
15-2-1954	8.75
1-1-1955	10.00
1-6-1955	12.00
15-11-1955	12.00
8-8-1956	11.00
6-2-1957	13.00
7-8-1957	11.50
28-3-1958	11.00
6-10-1958	11.00
12-1-1959	11.50
5-8-1959	12.50
1-2-1960	15.00
11-4-1960	16.00
8-3-1961	45.00
3-2-1962	49.50
1-10-1962	45.00
7-1-1963	36.00
2-3-1964	35.45
14-8-1964	34.16
1-9-1968	36.00
8-8-1969	35.00
28-8-1969	34.00
4-3-1970	32.00
22-2-1971	31.00
24-12-1971	33.50
23-4-1973	34.50
1-8-1973	42.50
12-10-1973	55.00
1-1-1974	88.00
10-7-1974	150.00
20-1-1975	100.00
1-7-1975	65.00
1-11-1976	70.00
1-5-1977	100.00
1-5-1978	135.00

Source:—Mysore Government Sandalwood Oil and Soap Factory, Bangalore.

ANNEXURE VI

Monthly estimated average prices of Sandalwood Oil in different markets for the years
1970-71 to 1980-81

Market	Year	Months												Yearly Ave- rage
		April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	March	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Salem/Kuppam	1970-71	265	265	265	265	270	270	265	270	270	260	265	260	262
Tiruvannamalai	1971-72	260	270	270	270	273	273	275	275	275	270	275	265	271
	1972-73	265	265	265	275	278	275	275	275	270	265	270	275	272
	1973-74	275	275	275	340	400	400	475	625	675	775	950	1050	518
	1974-75	1150	1300	1300	1450	1475	1250	1050	1000	1050	950	775	725	1127
	1975-76	630	600	610	525	500	500	515	520	525	660	610	620	559
	1976-77	625	650	690	925	860	840	875	900	1025	1200	1200	1250	920
	1977-78	1325	1330	1350	1350	1350	1275	1250	1250	1125	1050	950	950	1217
	1978-79	950	1050	1075	1075	1090	1025	1000	970	950	925	850	850	976
	1979-80	860	875	850	850	850	850	825	825	850	850	850	850	850
	1980-81	825	825	825	825	750	730	690	675	650	660	675	725	738
Calcutta	1970-71	250	240	255	240	250	285	285	285	275	280	285	285	268
	1971-72	285	295	295	275	275	275	295	295	295	295	295	295	289
	1972-73	260	265	285	295	295	285	275	275	275	300	305	305	285
	1973-74	335	365	390	405	375	425	455	465	465	465	475	475	425
	1974-75	545	675	790	855	975	1025	1075	1075	1100	1075	1025	925	928
	1975-76	850	775	700	775	775	738	738	738	738	738	775	830	764
	1976-77	825	825	805	770	765	725	653	653	790	1000	980	740	796

ANNEXURE VI- *Contd.*

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
	1977-78	875	925	975	1050	1075	1125	1225	1275	1225	1225	1225	1225	1119
	1978-79	1275	1270	1225	1225	1225	1220	1225	1175	1205	1185	1175	1175	1215
	1979-80	1050	1050	975	975	975	975	905	915	925	925	925	925	960
	1980-81	975	1050	1103	1135	1000	1025	1025	1025	1025	975	975	1025	1028
Cochin	1970-71	}	-----N.A.-----											
	1971-72													
	1972-73													
	1973-74													
	1974-75	1100	1250	1250	1375	1450	1125	1000	950	950	875	875	625	1069
	1975-76	625	550	550	500	475	475	450	490	500	550	575	575	526
	1976-77	600	625	725	750	800	813	838	850	975	1100	1225	1275	881
	1977-78	1225	1263	1300	1250	1300	1225	1225	1150	1075	1000	913	888	1151
	1978-79	888	1000	1000	1050	1075	988	963	945	900	863	800	825	941
	1979-80	825	825	838	868	838	838	813	813	813	813	813	810	827
1980-81	813	813	800	800	713	725	700	638	638	638	650	650	715	
Kanpur	1972-73	}	-----N.A.-----											
	1973-74													
	1974-75													
	1975-76													
	1976-77	550	600	750	800	800	800	800	800	900	1000	1200	1200	850
	1977-78	1250	1250	1550	1250	1250	1200	1000	1000	1000	1000	900	900	1129
	1978-79	900	900	1000	1000	1000	1050	1050	900	850	850	725	725	913
	1979-80	725	750	800	825	630	850	850	850	825	825	825	825	800
	1980-81	800	725	750	760	750	725	725	700	650	625	625	625	705

ANNEXURE VII

Cost of production of Sandalwood Oil as furnished by M/s. Karnataka Soaps and Detergents Limited, Bangalore for the years 1975-76 to 1979-80

Year	Sandalwood	Fuel	Stores & Chemicals	Wages	Salaries and establishment	Depreciation	Other items	Total manufacturing exp.	Yield of oil from 100 Kgs. S. wood	Selling and overhead expenses	Cost of production of 1 kg. of oil
	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. P.	Rs. p.	Rs. P.	Rs. P.	in Kgs.	Rs. P.	Rs. P.
Mysore											
1975-76 . . .	359.36	23.46	6.45	29.44	11.00	6.00 (—)	31.86	467.57	4.20	19.85	116.05
1976-77 . . .	350.27	28.14	4.12	26.41	10.14	5.49	11.23	435.80	4.23	58.80	116.93
1977-78 . . .	778.18	25.93	3.07	17.66	6.44	2.59 (—)	11.87	822.00	4.38	33.80	195.38
1978-79 . . .	668.51	28.95	6.71	29.48	11.58	5.25 (—)	21.68	728.80	4.26	76.17	188.96
1979-80 . . .	735.64	38.44	19.35	43.68	9.46	11.93 (—)	36.70	821.80	4.18	95.71	196.60
Shimoga											
1975-76 . . .	317.22	27.22	3.13 ¹	20.19	7.17	5.78 (—)	3.98	376.73	4.29	19.85	92.44
1976-77 . . .	355.38	28.19	4.01	18.24	6.67	4.58 (—)	2.00	415.07	4.28	58.80	110.72
1977-78 . . .	695.32	25.41	3.51	17.30	5.88	3.85 (—)	5.33	745.94	4.28	33.80	182.18
1978-79 . . .	645.63	31.96	3.07	24.02	7.56	5.16 (—)	13.18	704.22	4.25	76.17	183.62
1979-80 . . .	716.63	45.00	6.50	23.38	7.56	4.08 (—)	6.64	796.51	4.24	95.71	210.43

ANNEXURE VIII

Grading statistics of Sandalwood Oil under Agmark from 1963-64 to 1980-81

Year	Quantity (Tonnes)	Value Rs. in lakhs
1963-64	99.8	147.20
1964-65	111.8	167.18
1965-66	112.7	167.58
1966-67	109.8	226.87
1967-68	104.9	262.34
1968-69	140.6	365.21
1969-70	137.1	339.63
1970-71	127.5	294.29
1971-72	124.3	272.0
1972-73	134.4	319.98
1973-74	101.9	464.86
1974-75	98.5	1032.56
1975-76	47.9	532.35
1976-77	72.0	532.35
1977-78	90.5	908.24
1978-79	75.2	717.87
1979-80	60.5	433.95
1980-81	51.7	382.80

ANNEXURE IX

Number of factories producing Sandalwood Oil and number of stills employed with each

Sl. No.	Name of the factory	No. and capacity of stills employed by each	Total distillation capacity
1	2	3	4
1.	M/s. Karnataka Soap & Detergents Ltd., Mysore	2 × 26 tonnes	22 tonnes
	Do. Shimoga	2 × 20 tonnes	40 tonnes
2.	M/s. South India Industrial Work Pvt. Ltd., Kuppam	5 × 1/2 = 2.5 tonnes	2.5 tonnes
3.	M/s. Kangunndi Industrial Work (Pvt.) Ltd., Kuppam	6 of 0.5 tonnes	3.00 tonnes
4.	M/s. East Indian Sandal Oil Distillery (Pvt.) Ltd., Kuppam (Chittoor Distt.)	2 of 0.5 tonnes 3 of 0.75 tonnes 2 of 1.5 tonnes	} 6.25 tonnes
5.	M/s. Mysore Essential Oils, Kuppam	3 of 1.5 tonnes 1 of 0.95 tonnes 1 of 1.00 tonnes	
6.	M/s. Metro Corporation, Hyderabad	4 stills of 0.5 tonnes 2 in operation (Production from each still is 20—25 kg)	2.00 tonnes 3.5 tonnes
7.	M/s. Devi Prasad Prayag Dutt., Hyderabad	No. of stills 7 All are in operation producing 20—37 kg. of oil in each still	500 kg.
8.	M/s. Dilpasand & Co., Shankerapply, Hyderabad	1	2 tonnes
9.	M/s. Annapurna Distillery		Not available
10.	M/s. Bharat Sandal, Salem	5 } 1 of 1 tonne = 1 3 of 0.75 tonnes = 2.5	} 3.75 tonnes
11.	M/s. Salem Essential Oils, Salem	1 of 0.5 tonne = 0.50	

ANNEXURE IX--Contd.

1	2	3	4	
12.	M/s. Mettur Sandal Oil Co., Mettur 4 dam, Distt. Salem.	3 of 1 tonne 1 of 2 tonnes	= 3.00 = 2.00	5.00 tonnes
13.	M/s. Shanmuga Industries, Tiruvannamalai . . .	5 of 0.5 tonnes	= 2.5 tonnes	2.5 tonnes
14.	M/s. Indian Fragrance & Chemical Works, Kannauj	1 of 3.00 tonnes		3.00 tonnes
15.	M/s. Ram Narain Pratap Narain, Kannauj . . .	1 of 6.0 tonnes		6.0 tonnes
16.	M/s. Munna Lal Sons & Co. Kannauj . . .	1 of 3.5 tonnes		3.5 tonnes
17.	M/s. Hindustan Sandalwood and Essential Oil Distilleries, Kannauj . . .	1 of 2.0 tonnes		2.00 tonnes
18.	M/s. M. S. Sandalwood Oil & Distillery, Kannauj	1 of 1.5 tonnes		About 1.5 tonnes
19.	M/s. Chandrawali & Sons, Kannauj . . .	1 of 1.5 tonnes		About 1.5 tonnes
20.	M/s. S. I. Sandalwood Oil Distillery, Kannauj	1 of 1.5 tonnes		About 1.5 tonnes
21.	M/s. Malayagiri Sandalwood Oil Distillery, Kanpur	1 of 4.5 tonnes		4.5 tonnes
22.	M/s. Essentials and Sandalwood Oil, Kanpur.	1 of 3.5 tonnes		3.5 tonnes
23.	M/s. Debicharan Misra & Sons, Kanpur . . .	1 of 2.0 tonnes		2.00 tonnes
24.	M/s. Chemnad Essential Oil & Allied Products Co., Kasargod, Kerala . . .	2.5 tonnes		2.5 tonnes (in operation 1 tonne)
25.	M/s. Kerala Sandalwood Oil Distilleries P.O., Cheeral (Wynad), Kerala . . .	4 tonnes		4.0 tonnes
26.	M/s. Elley Aromatic Industries, Checrakuzha Palghat (Kerala) . . .	3 tonnes		3.0 tonnes
27.	M/s. Evergreen Fragrance, Wynad (Kerala) . . .	1.5 tonnes		1.5 tonnes
28.	M/s. Kerala Sandalwood Oil Co., Calicut . . .	1.5 tonnes		1.5 tonnes
29.	M/s. Sorabji Naoroji & Co., Bombay . . .	6 stills of 0.5 M.T. production is about 4000 kg in a year.		3.0 tonnes
30.	M/s. Durga Sandal Factory, New Delhi . . .	0.5 tonnes		0.5 tonnes
31.	M/s. Industrial Products of India, Delhi . . .	1.8 tonnes		1.8 tonnes
Total distilling capacity				175.75 tonnes

ANNEXURE X-A

Export of essential oils, perfumes & flavouring materials, for the years from
1977-78 to 1980-81Quantity in Kg.
Value in Rs.

Sl. No.	Commodity/ Item	1977-78		1978-79		1979-80		1980-81	
		Qty	Value	Qty.	Value	Qty.	Value	Qty.	Value
1	2	3	4	5	6	7	8	9	10
(A) Essential oils resinoid									
1.	Anise oil	..	..	135	2000	2000	24,013	..	..
2.	Bergamot oil	28	1065	..	..	..	..	..	..
3.	Cajaput oil	..	..	1000	174,069	..	..	1	182
4.	Cardamom oil	1147	22,11,664	1401	33,14,517	747	15,78,216	853	14,67,067
5.	Cedarwood oil	1000	23,000	..	..	275	9,000	..	..
6.	Clove oil	148	7,995	375	20,808	120	7,630	202	8,191
7.	Cinnamon leaf oil	..	..	31	1,730	..	..	200	9,300
8.	Caraway oil	..	..	..	..	..	..	100	80,935
9.	Dill oil	..	..	18	381	..	..	..	..
10.	Eucalyptus oil	12,964	6,74,518	1,732	1,20,514	4,805	3,72,429	682	27,897
11.	Ginger oil	1,281	9,35,201	7,341	45,98,202	12,283	56,99,657	6,367	25,50,194
12.	Ginger grass oil	100	13,200	..	..	180	23,800	..	..

	1	2	3	4	5	6	7	8	9	10
13. Geranium oil	..	..	..	..	..	..	..	..	2,400	1,40,000
14. Keora oil	300	24,256	528	38,921	3294	3,01,734	..	..	..	..
15. Kokum oil	1,03,000	27,46,505	..	..	..	..	..	..	..	..
16. Lemongrass oil	1,49,024	99,49,636	71,578	50,11,358	2,49,280	1,72,66,861	3,13,425	2,15,51,199		
17. Palmarosa oil	21,650	28,83,677	15,764	32,96,953	14,956	29,23,440	7,280	14,42,468		
18. Pepper oil	1,639	3,63,112	4,177	6,54,508	7,438	11,35,001	5,527	7,55,613		
19. Nutmeg oil	..	..	..	..	313	18,500	..	..	..	..
20. Sandalwood oil	22,647	2,85,72,084	25,293	2,40,39,630	43,001	3,43,47,789	37,638	2,96,47,978		
21. Vetiver oil	200	1,14,000	200	1,09,613	406	2,25,660	109	8,260		
22. Ylang Ylang oil	..	..	60	802	..	..	..	..	..	..
23. Oil of spice NES	129	49,068	494	1,82,577	4,732	14,30,682	2,567	8,29,248		
24. Piperment oil Ex-montha arvensis	30	1,889	..	..	7,400	4,06,213	5,790	5,44,757		
25. Piperment oil Ex-pipperita	..	..	..	..	50	2,671	11,800	6,87,190		
26. Dementholised piperment oil	..	..	..	..	..	..	5,580	3,11,000		
27. Rosa oil	21,717	14,11,620	70,431	50,11,258	48,302	34,56,068	51,635	39,71,247		
28. Essential oil NES	37,438	29,18,615	27,623	27,07,019	30,060	41,90,193	36,060	45,71,689		

ANNEXURE X-A—Contd.

1	2	3	4	5	6	7	8	9	10
29.	Terpenic by product (Deterpenation of Essential oils)	100,713	1,400	..	..	..	..	..	..
30.	Attars all kinds . . .	1,75,350	1,09,020	2,25,152	7,26,197	3,56,794	8,17,545	2,37,738	5,73,905
31.	Other Concentrs. of essential oils . . .	4,380	1,30,375	4,205	9,70,973	6,153	9,36,946	7,335	15,34,469
(B)	Mixture adiferus substance used as Raw material in perfumery food etc.								
32.	Mixture aromatic Chemicals & Ess. oils . . .	11,623	7,33,716	25,988	13,84,823	23,786	16,50,215	19,616	16,26,973
33.	Syn. Essential oils . . .	5,893	4,69,949	3,491	4,22,801	1,078	96,004	285	15,440
34.	Food Essence prepared . . .	..	..	..	..	..	..	466	86,067
35.	Others . . .	495	41,384	869	51,120	2,367	3,78,537	377	60,067
Total . . .			5,43,86,946		5,28,40,774		7,72,98,804		7,25,01,290

Source : Monthly Statistics of Foreign Trade of India Vol. I.

ANNEXURE X-B

**Import of essential oils, perfumes and flavouring materials
for the years 1977-78 to 1980-81**

Quantity in Kg.
Value in Rs.

Sl. No.	Commodity/ Item	1977-78		1978-79		1979-80		1980-81	
		Qty.	Value	Qty.	Value	Qty.	Value	Qty.	Value
1	2	3	4	5	6	7	8	9	10
(A)	Essential Oil resinoid								
1.	Anise oil	2,571	3,66,724	3,481	2,25,558	4,255	5,70,557	1,542	2,87,065
2.	Bergamot oil	10,007	10,35,267	8,222	13,11,324	81,133	15,31,259	4,451	12,52,863
3.	Cajaput oil	629	32,290	842	50,397	50	2,360	..	..
4.	Cananga oil	151	28,304	847	1,72,723	2,594	3,05,690	1,624	1,82,205
5.	Caraway oil	115	26,190	76	29,899	175	27,799	..	..
6.	Cardamom oil	5	217	..	..	..	..	..	..
7.	Cedarwood oil	438	17,925	200	20,491	320	15,560	..	..
8.	Cinnamon bark oil	1,220	65,155	25	3,835	145	25,995	1,237	70,596
9.	Cinnamon leaf oil	10,165	6,05,560	5,970	3,45,989	15,225	6,75,497	14,873	6,13,853
10.	Clove oil	58,956	33,30,433	55,344	32,15,816	43,561	24,95,836	63,587	33,03,776
11.	Coriander seed oil	82	22,024	384	50,669	225	53,321	80	26,210
12.	Eucalyptus oil	235	19,076	10	5,301	..	..	..	..
13.	Dill oil	892	67,785	295	50,243	500	66,922	..	..

ANNEXURE X-B—Contd.

1	2	3	4	5	6	7	8	9	10
14.	Ceranium oil	6,720	16,39,118	18,039	43,35,646	23,682	59,58,510	14,954	39,03,312
15.	Ginger grass oil	22	1,722	..	..	..	..	400	53,283
16.	Keora oil	63	7,665	..	..	..	..	200	19,884
17.	Lavender oil	15,279	19,12,147	28,675	28,95,575	20,974	20,83,270	26,146	30,75,487
18.	Lemon oil	12,313	4,80,519	16,579	12,68,013	12,962	9,06,559	17,554	10,27,439
19.	Lemongrass oil	..	..	100	10,444	250	34,129	443	43,118
20.	Nutmeg oil	10,500	3,93,299	3,742	3,26,680	4,399	2,92,662	7,552	3,57,960
21.	Orange oil	53,184	8,56,575	1,29,593	16,13,380	1,20,578	15,29,804	96,929	20,00,478
22.	Patchouli oil	70,859	45,13,861	62,063	54,31,559	50,222	42,45,664	51,227	66,62,358
23.	Petigrain oil	3,970	3,54,219	5,081	3,92,295	8,077	6,71,680	6,691	6,03,319
24.	Palmarosa oil	..	..	..	..	100	11,364	..	..
25.	Sandalwood oil	257	24,849	..	..	..	..	..	..
26.	Spearmint oil	5,057	5,62,200	25,913	28,14,224	11,932	11,51,825	52,218	41,16,214
27.	Vetiver oil	500	29,000	..	..	100	16,410	100	13,760
28.	Ylang Ylang oil	1,282	2,46,274	1,370	2,99,538	1,548	4,23,853	1,234	2,69,820
29.	Oil of spice NES	1,930	26,307	70	4,926	100	29,652	800	1,04,320
30.	Pippermint oil Ex mentha arvanis	5,844	10,98,728	25,525	48,91,738	8,472	16,06,016	1,597	3,20,440

1	2	3	4	5	6	7	8	9	10
31.	Pippermint oil Ex. Piperita	10,819	20,77,556	14,239	28,52,105	8,684	18,58,712	10,615	21,57,540
32.	Dementholised Pippermint oil	296	45,504	230	1,22,410	..	..	..	..
33.	Citronella oil Jawa type	168	10,595	15,461	5,36,774	..	..	..	..
34.	Citronella oil Ceylon type	120	8,670	100	4,656	..	..	..	..
35.	Rose oil	14,432	13,33,052	3,857	4,50,619	3,912	4,70,866	18,761	13,16,022
36.	Resinoids	37,083	27,73,726	57,179	33,92,866	26,130	27,99,309	31,693	35,24,512
37.	Essential oil NES	83,538	83,27,417	1,03,270	88,89,064	1,43,582	1,32,79,144	90,299	1,39,82,136
38.	Other conctrs. of essential oils	1,63,613	9,25,346	24,431	20,51,369	7,987	8,47,704	9,271	4,97,870
(B)	Mixture odoriferous substance etc. used as raw material in perfumery food etc.								
39.	Mixture aromatic chemicals & essential oils	1,176	1,32,290	4,867	9,66,103	772	2,78,437	945	56,801
40.	Synthetic essential oil	17,466	10,70,156	6,322	14,94,303	3,894	9,18,067	1,383	4,20,181
41.	Others	10,476	7,25,680	1,918	1,24,354	8,055	9,00,711	14,216	5,54,116
	Total		3,51,93,675		5,06,50,886		4,60,85,144		5,08,16,938

Source : Monthly Statistics of Foreign Trade of India, Vol. 2.

ANNEXURE XI

The Essential Oils Grading and Marking Rules, 1954

1. **Short title and application.**—(i) These rules may be called the Essential Oils Grading and Marking Rules, 1954.

(ii) They shall apply to essential oils produced in India.

2. **Grade designations.**—Grade designations to indicate the quality of essential oils produced in India shall be set out in column I of Schedules III to VII annexed to these rules.

3. **Definition of Quality.**—The quality indicated by the grade designation shall be as set out against such designations in schedules III to VII annexed to these rules.

4. **Grade designation marks.**—The grade designations mark shall consist of a label bearing design consisting of an outline map of India with the word "AGMARK" and the figure of the rising sun with words "Produce of India" resembling that set out in schedule I specifying the names of the essential oil, the grade designation and in colour specified in the aforesaid schedule.

5. **Method of Marking.**—(i) the grade designation mark shall be securely applied to each container in the manner approved by the Agricultural Marketing Adviser to the Government of India and the following particulars shall be marked on the container or the label:—

- (a) Name of packer;
- (b) Place of packing;
- (c) Date of packing; and
- (d) Lot number.

(ii) An authorised packer may after obtaining the previous approval of the Agricultural Marketing Adviser to the Government of India, mark his private trade mark on a container in a manner approved by the said officer :

Provided that the private trade mark does not represent quality or grade of essential oil different from that indicated by the grade designation mark affixed on the container in accordance with the said Rules.

(iii) Only clean containers which shall be securely closed and sealed in a manner approved by the Agricultural Marketing Adviser to the Government of India shall be used for packing.

6. **Special Conditions of Certificate of Authorisation.**—In addition to the conditions specified in rule 4 of the General Grading and Marking Rules, 1937, the conditions set out in Schedule II, shall also be the conditions subject to which a Certificate of Authorisation is issued for the purposes of Rules.

SCHEDULE I

(a) *Grade designation mark for essential Oils*
(See rule 4)

(b) *Colour Scheme*

(i) Lemongrass oil.

Grade designation	Colour of lettering showing the grade	Colour of border of the label
Special.....	Red.....	Red
Grade A.....	Green.....	Green

(ii) Sandalwood oil.

Grade Designation	Colour of lettering showing the grade	Colour of the border of the label
Grade A.....	Red.....	Red

(iii) Palmarosa oil

Grade designation	Colour of lettering showing the grade	Colour of the border of the label
Special.....	Red.....	Red
Grade A.....	Green.....	Green

(iv) Gingergrass oil

Grade designation	Colour of lettering showing the grade	Colour of the border of the label
Grade.....	Red.....	Red

(v) Eucalyptus oil.

Grade designation	Colour of lettering showing the grade	Colour of the border of the label
Special.....	Red.....	Red
Grade A.....	Green.....	Green

SCHEDULE II

(See rule 6)

(a) An authorised packer shall have suitable arrangements for filtration blending and storage of essential oils.

(b) If an authorised packer handles more than one essential oil on the same premises, adequate precautions shall be taken to avoid the mixing of different oils.

(c) An authorised packer shall make such arrangements for test essential oils as may be prescribed and a duplicate sample from each lot of essential oil to be graded shall be forwarded to such Control Laboratory as may be notified from time to time by the Agricultural Marketing Adviser to the Government of India.

(d) All instructions regarding the methods of sampling, analysis, packing, etc., which may from time to time be issued by the Agricultural Marketing Adviser to the Government of India, consistent with the provisions of the Act and the Rules made thereunder shall be strictly observed.

SCHEDULE IV*

Grade designations and definitions of quality of East Indian sandalwood oil
(See rules 2 and 3)

Grade Designation	Physico-chemical characteristics					Description and appearance
	Specific gravity at 30°/30°C**	Optical rotation	Refractive index at 30°C†	Free alcohol (santalol) content	Solubility in 60% ethyl alcohol (by volume)	
1	2	3	4	5	6	7
Grade A	0.962 to 0.976	-15° to -20°	1.4990 to 1.5060	Not less than 90%	Soluble in 5 volumes	The East Indian Sandalwood oil shall be the pale-yellow or nearly colourless essential oil obtained by steam distillation and/or water distillation of <i>Santalum Album Linn.</i> only, and shall be free from admixture with any other oil or substance. It shall be clear, free from sediment and suspended matter. It shall be dry and shall have the characteristic faint but persistent odour and pleasant taste.

*The specifications are based on the India Standard Specification for sandalwood oil (IS: 320--1952).

**The correction factor for specific gravity for each degree centigrade rise in temperature shall be (-) 0.0070.

†The correction factor for refractive index for each degree centigrade rise in temperature shall be (-) 0.00039.

ANNEXURE XII

Certificate of Agmark Grading (Specimen)

GOVERNMENT OF INDIA
 MINISTRY OF RURAL DEVELOPMENT
 Directorate of Marketing & Inspection

Book No.

Certificate No.

Office of the Deputy Senior Marketing Development Officer, Essential Oils Grade Scheme

Cochin-3, dated the.....198

Certificate of AGMARK Grading

CERTIFIED that the consignment of Lemongrass/Sandalwood oil as per details given below has been found to conform to the specification prescribed for the oil under the Essential Oils Grading and Marking Rules, 1954.

Name of authorised packer.....

Details of Certificate issued, if any.....

Particulars of Packages

Name, Grade of the oil and lot No.	Number of packages	Agmark Labels No.		Citral/Santalol per cent at the time of grading	Party's shipping numbers		Party's marks
		From	To		From	To	
1	2	3		4	5	6	

REMARKS :

*Deputy Senior Marketing Development Officer
 Essential Oils Grading*

NOTE.— The original is meant for the Customs use.

ANNEXURE XIII

Names of Associations and Institutions related with Sandalwood and its oil

1. Forest Research Institute and College, Dehradun.
2. Sandal Research Centre, Bangalore.
3. Indian Institute of Science, Bangalore.
4. Essential Oil Association of India, H.B.T.I., Campus, Kanpur.
5. Aromatic Traders Association, 41, Ezra Street, Calcutta.
6. Perfumes and Flavour Association of India, 2-B Cant Chamber IIInd Floor 35, Sri Vithaldas Thakersey Marg., Bombay.
7. Basic Chemicals, Pharmaceuticals and Cosmetics Export Promotion Council, Bombay.
8. Indian Sandalwood Advisory Board.
9. State Forest Research Institute, Jabalpur.
10. Council of Scientific & Industrial Research, New Delhi.
11. Indian Council of Agricultural Research, New Delhi.
12. Central Institute of Medicinal and Aromatic Plants, 474/6, Sitapur Road, Lucknow.
13. Regional Research Laboratory, Jammu.
14. Regional Research Laboratory, Jorhat.
15. Regional Forest Research Laboratory of Forest Research Institute, Bangalore.
16. Indian Standard Institution, New Delhi.
17. Forest Research Institute, Coimbatore.

ANNEXURE XIV

List of International Standard Organisation and Publications on Essential Oils

Doc. Number	Title	Year Published
ISO/R 210	Essential Oils Packing	1961
ISO/R 211	Essential Oils Labelling and marking containers	1961
ISO/R 212	Essential Oils Sampling	1973
ISO/R 278	Standard layout for methods of analysis of Essential Oils.	1962
ISO/R 279	Determination of the density and relative density	1962
ISO/R 280	Essential Oils determination of Refractive Index	1976
ISO/R 356	Essential Oils Preparation of test samples	1977
ISO/R 592	Determination of the Optical rotation of Essential Oils.	1967
ISO/R 709	Determinations of ester value and calculation of ester content of essential oils.	1968
ISO/R 875	Determination of solubility of essential oils in ethanol.	1968
ISO/R 1041	Essential oils determination of Freezing point.	1973
ISO/R 1202	Essential oil determination of Cinole content.	1970
ISO/R 1241	Essential oils, estimation of free alcohols content by determination of ester value after acetylation.	1973
ISO/1242	Essential oils determination of the acid value	1973
ISO/1271	Essential oils determination carbonyl compounds content free hydroxylamine method	1972
ISO/1272	Essential oils determination of Phenol content	1973
ISO/1279	Essential oils determination of carbonyl compounds content hydroxylammonium chloride method	1973
ISO/3793	Essential oils, Estimation of Primary and secondary free alcohols content by acetylation in Pyridone.	1976
ISO/3794	Essential oils, Estimation (Containing tertiary alcohols) of free alcohols content by determination of ester value after acetylation.	1976

ANNEXURE XIV—*Contd.*

Doc. Number	Title	Year Published
ISO/3812	Essential Oils of Geranium and Rose determination of ester value after hot formylation.	1976
ISO/4096	Essential Oils (containing tertiary alcohols) evaluation of free alcohols contents by determination of ester value after cold formylation.	1978
ISO/5991	Essential Oils determination of the residue from distillation under reduced pressure.	1979
ISO/R 590	Oil of Brazilian Sassafras	1967
ISO/R 770	Oil of Eucalyptus globulus	1968
ISO/R 855	Oil by Lemon, expressed, Italy	1968
ISO/R 856	Oil of Peppermint, France, Italy, UK, USA	1968
ISO/R 1342	Oil of Rosemary	1971
ISO/3033	Oil of Spearmint	1975
ISO/3043	Oil of Pimentoberry	1975
ISO/3044	Oil of Eucalyptus citriodora	1974
ISO/3045	Oil of bay	1974
ISO/3053	Oil of Grape fruit (obtained by expression)	1975
ISO/3054	Oil of Lavandin abrialis	1976
ISO/3062	Oil of Sandalwood (<i>Caryaspicata</i>) Australia	1974
ISO/3064	Oil of Petitgrain, Paraguay	1977
ISO/3065	Oil of Australian Eucalyptus 80 to 85% Cineole content.	1974
ISO/3140	Oil of Sweet orange (obtained by expression)	1976
ISO/3141	Oil of Clove leaf	1975
ISO/3142	Oil of Clove stem	1975
ISO/3143	Oil of Clove bud	1974
ISO/3214	Oil of Fitsea cubeba	1974
ISO/3215	Oil of Nutmeg	1974
ISO/3216	Oil of Cussia	1974
ISO/3217	Oil of Lemongrass (<i>Cymbopogon citratus</i>)	1974

Doc. Number	Title	Year Published
ISO/3218 . . .	Essential oils Principles of Nomenclature	1976
ISO/3475 . . .	Oil of Aniseed	1975
ISO/3515 . . .	Oil of French lavender	1976
ISO/3517 . . .	Oil of Niroli	1975
ISO/3519 . . .	Oil of Lime, obtained by distillation	1976
ISO/3523 . . .	Oil of Cananga	1976
ISO/3524 . . .	Oil of Cinnamon Leaf	1977
ISO/3525 . . .	Oil of Amyris	1979
ISO/3526 . . .	Oil of Spanish Sage	1976
ISO/3527 . . .	Oil of Parseling Fruit	1975
ISO/3528 . . .	Oil of Mandarin, Italy	1977
ISO/3756 . . .	Oil of Cubeb	1976
ISO/3757 . . .	Oil of Patchauli	1978
ISO/3760 . . .	Oil of Celery Seed	1979
ISO/3761 . . .	Oil of Rose wood Brazil	1976
ISO/3809 . . .	Oil of Lime (obtained by expression of the whole fruit)	1976
ISO/3848 . . .	Oil of Java Citronella	1976
ISO/4731 . . .	Oil of Geranium	1978

Source :—Secretariat of Technical Committee ISO/TC-54 Dirett AO—
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ANNEXURE XV

Major exporters of Sandalwood Oil registered with Basic Chemicals, Pharmaceuticals & Cosmetic Export Promotion Council, Bangalore

1. M/s Attar Md. Dawood & Bios.,
43, Old Bengali Purā Street,
Bombay-400 003.
2. M/s Creative Fragrances,
Post Box No. 1336, (G.P.O.)
New Delhi-110 006.
3. M/s D.V. Deo,
P.B. No. 135,
Pandit Road Corner,
Cochin-682 002.
4. The East Indian Sandal Oil Pvt.
Ltd.,
Krishnagiri Road,
Kuppam-517 425,
Andhra Pradesh.
5. M/s Haji Atiq & Sons,
211, Nagdevi Street,
Bombay-400 003.
6. M/s Jagan Nath Prem Nath,
6295, Gali Batashan,
Delhi-110 006.
7. M/s Junoglobal Exporters,
11, C.N. Krishnaswamy Road,
Chepauk,
Madras-600 005.
8. M/s K. Kar,
32-E, Jackson Lane,
Calcutta-700 001.
9. M/s K.L. Ramnarain,
Perfumers, M.G. Road,
Kannauj, U.P.
10. M/s Malayagiri Sandalwood
Oil Distillery,
88-B, Co-operative Industrial
Estate,
Vivekanand Nagar,
Kanpur-208 002.
11. M/s The Mercantile
Essential Oil Co.
48/52, Perin Nariman St.,
Fort, Bombay-400 001.
12. M/s Mysore Sales International
Ltd.,
36, Cunningham Road,
Bangalore-560 052.
13. M/s Navin Bharat Manufac-
turers, D-373, Defence
Colony,
New Delhi-100 024.
14. M/s Otoco Overseas,
12, Bell Lane,
Fort,
Bombay-400 001.
15. M/s Pravinchandra Devidas
& Co., 3-B, Mangaldas Bldg.,
29, Mangaldas Road,
Bombay-400 002.
16. M/s Radha Sales Copn.,
548, Fasil Road,
Lahori Gate,
Delhi-110 006.
17. M/s Ramnarain Pratapnarain,
P.O. Box No 3,
M. G. Road,
Kannauj-209 725.
18. M/s Sony Industries,
160, Princess Street,
Chikkhal House,
Bombay-400 002.
19. M/s Techno-Chemical
Industries Ltd.,
P. Box No. 74,
Calicut-673 001 (Kerala).
20. M/s Wodex Pvt. Ltd.,
65, Blumoon Complex,
M.G. Road,
Bangalore-560 001.

ANNEXURE XVI

List of Field Officers associated with the survey on the Marketing of Sandalwood and its oil in India

1. Shri N. Venkataraman, Asstt. Marketing Officer, Kuppam.
2. Shri S.S. Bimbira, Asstt. Marketing Officer, Bangalore.
3. Shri C.V. Nagaraj, Jr. Chemist, Bangalore.
4. Shri N. G. Shukla, Asstt. Marketing Officer, Patna.
5. Shri S.R. Shukla, Asstt. Marketing Officer, Patna.
6. Shri B.N.K. Sinha, Asstt. Marketing Officer, Patna.
7. Shri Jai Prakash, Asstt. Marketing Officer, Patna.
8. Shri Ram Singh, Dy. Senior Marketing Officer, Bhopal.
9. Shri S. P. Saxena, Asstt. Marketing Officer, Bhopal.
10. Shri B.K. Ghosh, Dy. Senior Marketing Officer, Hyderabad.
11. Shri John Peter, Asstt. Marketing Officer, Hyderabad.
12. Shri S. C. Khurana, Asstt. Marketing Officer, New Delhi.
13. Shri G.B. Dandi, Asstt. Marketing Officer, Bhubaneswar.
14. Shri S.B. Chakraborty, Marketing Officer, Calcutta.
15. Shri K.P. Singh, Asstt. Marketing Officer, Ahmedabad.

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